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ORIGINAL MEMOIRS.

THE TREATMENT OF THE UNDESCENDED OR MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA.*

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AN undescended testis is not such a very rare complication of hernia, as the statistics at the Hospital for Ruptured and Crippled, as well as those of the London Truss Society show. In 59,235 cases of inguinal hernia in males observed at the Hospital for Ruptured and Crippled from 1890–1907, there were 737 cases of undescended testis.

The basis of the present paper is a study of 126 cases upon which I personally operated. In spite of the fact that the subject has received considerable attention in the last few years (and was the main topic of discussion at the meeting of the French Surgical Society, a year ago) there is by no means unanimity of opinion as to the indications for surgical treatment, and there is also a wide difference of opinion as to the best methods of operation. Furthermore, few large statistics exist in which the after-results of operation are

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stated, and it is with special reference to this point that I trust that my own series may prove of interest.

The testis is first placed in the lumbar region, a little to one side of the vertebra, close to the primitive kidney. It descends along the posterior abdominal wall accompanied by or rather following the vaginal process of peritoneum which has preceded it, until it finally reaches the bottom of the scrotum.

In certain cases and due to a variety of causes, its downward progress may be interrupted at almost any point, giving rise to the different types of undescended or maldescended testis. If its progress is stopped before it enters the inguinal canal, it is called abdominal ectopia; if it is stopped within the inguinal canal, it is called inguinal ectopia; if it passes outward to the external canal into the region of the upper scrotum, it is called pubic ectopia.

The varieties thus far mentioned refer only to cases of interruption of the organ in its normal descent. There are cases, however, which, instead of being described as "undescended testis" more properly come under the heading of maldescended testicle, the testicle occupying some abnormal position, *e.g.*, perineum, Scarpa's triangle, or the aponeurosis of the external oblique, in the region of the anterior superior spine. These different varieties may be designated as inguinoperineal, inguinosuperficial, and inguinocrural ectopia.

Perineal ectopia, although described by Hunter in 1786 and afterwards by Curling in 1841, has received very little attention by surgical writers. Curling was the first to give a detailed description of the condition in 1857, and a report of 9 collected cases. He was also the first one to treat the condition by operation. The patient was an infant 4 weeks old. The result of the operation was unfortunate.

Godard in 1857 and 1860 reported two interesting cases, one a man 56 years of age, another of 22. The first case was originally an inguinal ectopia which, after having worn a bandage for a considerable time, became perineal; the second case was cruroscrotal ectopia.

In 1858 Partridge reported a case in which he performed castration. Some years later, James Adams reported the 13th case treated by operation up to that time. The patient died of peritonitis following the operation.

Annandale in 1879 was the first one who reported a case successfully treated by surgical intervention.

Monod and Terrillon in 1889 collected 30 cases of perineal ectopia, which number Weinberger in 1899 increased to 65. Adding to this the more recent cases collected by Klein in his admirable "Thèse de Paris" on Ectopia, we have a total of 81 cases up to this date.

As to the frequency of perineal ectopia, Rennes and Marshall report only 17 cases of ectopia in 14,400 recruits examined for military service, but not one of these is stated to be perineal.

Godard in 53 cases of ectopia found only 3 examples of the perineal variety.

McAdam Eccles in his work on the imperfectly descended testis states that out of 936 instances of imperfect descent of the testis, associated with hernia, only 5 were found to be of the perineal variety.

My own statistics show 9 examples of perineal ectopia in 126 cases of hernia with undescended or maldescended testis operated upon.

At the Hospital for Ruptured and Crippled there have been observed during the past 18 years 737 cases of undescended testis, and of these only 15 were of the perineal type. In 6 no operation was performed.

As regards the age of the patients, while the disease is of congenital origin, the testis is not always found in the perineum at birth. In certain cases it is situated just outside of the inguinal ring, or has passed below the pubic bone, and later on reaches the perineum. In practically all of my own cases the testis had always been present in the perineum, as far as was known. In the great majority of cases the condition is unilateral.

Hutchinson has reported one case in which both testicles

in a total of 2200 operations for hernia of all varieties were in the perineum, and Ammon has published a second such case.

Heredity.—Godard mentions a case in which the condition occurred in father and son, and Klein reports a case in which the brother of a patient had multiple dystrophies, particularly hypospadias.

Etiology.—Authorities differ widely as to the precise cause of descent of the testis into the perineum. Until recently there was a tendency to accept fully the opinion of Curling that had become almost classic, that the principal and almost only agent connected with the descent of the testis was the gubernaculum; and as the latter was admitted to have several fasciculi, one attached to the lower part of the scrotum another extending into the perineum to the margin of the ischium and a third into the pubic or femoral region, this seemed an easy and sufficient way of accounting for the different types of maldescent of the testis. In the perineal variety the fibres were supposed to be more fully developed than in the inguinal type, and by traction the testicle became lodged in this region.

Godard accepted the theory fully and believed nothing more simple than this explanation,—no gubernaculum and the testis remains within the abdomen; no middle fasciculus, and inguinal ectopia occurs, while in the event of the anomalous insertion of the fasciculus either in Scarpa's triangle or the ischium, we have cruroscrotal and perineal ectopia.

However, Bramann, in 1884, made a very careful study of 40 human embryos with special reference to the migration of the testicle, and as a result of these investigations declared that he had never been able to determine that the vaginal sac divides the fibres of the gubernaculum as it becomes inserted in the bottom of the scrotum.

Lockwood, in 1887, made one of the most careful anatomical studies of the undescended testis that has ever been made, and proved anew the plurality of the inferior insertions of the gubernaculum, and showed that during the 6th and 7th

month the fibres of the latter penetrate the inferior portion of the abdominal wall and extend into the triangle of Scarpa; others are attached to the pubis and root of the penis; others again extend behind the scrotum; in the 8th month, as dissections have shown, many of the inferior fibres of the gubernaculum pass into the peritoneum ending in the tuberosity of the ischium or become one with the sphincter ani.

Lockwood believes the gubernaculum the main factor in the descent of the testes, and attributes the various types of maldescent to over-development of portions of the gubernaculum lying in these particular regions. He states: "The muscular structure of the gubernaculum is, I think, unquestionable, and it seems irrational to deny its tissues their function, namely, that of traction." He regards it of special significance that in case of maldescent, the testicle migrates into particular regions in which, as has been well established, the fibres of the gubernaculum exist. I do not believe that Lockwood's argument is entirely convincing.

Later, Sébileau, after careful personal research upon the coverings of the testicle and its migration, concludes that "perineal ectopia is a purely congenital affair. It depends neither upon pathological nor anatomical causes and least of all upon the gubernaculum." He recognizes that the absence or insufficient development of the gubernaculum may explain abdominal and iliac retention. As regards the inguinal and extra-inguinal, he believes that the abdominal wall itself plays a very real and important rôle in offering difficulty to the complete passage of the testicle through the external ring.

Championniere in his "clinical lecture on anomalies of the testicle," gives the result of 44 operations in 39 patients. He strongly opposes the theory of the gubernacular origin of the undescended testis and says that only a physiology as legendary as that which, in former times, accepted multiple testes as proven facts, can seek to explain the descent of the testis by a legendary origin of the gubernaculum testis. The defects of the gubernaculum are invoked as a cause of non-descent and, quite naturally, these writers seek to supply its deficient

action by traction made upon the testicle either in the direction of the scrotum or in the direction of the thigh by structures more or less doubtful. Without discussing this, as he terms it, childish theory of the gubernaculum testis, Championniere states that we must admit that we do not know the cause of this descent. We can, however, generally affirm that we do know certain conditions which hinder it.

Championniere concludes from his observations that an ectopic testicle should always be preserved for the reason that, although it may have no functional value, it has an important influence upon the general health and virility of the subject. His own series of cases however shows that in 15 cases the testicle was sacrificed and in 19 cases orchidopexy was performed.

Among the chief reasons which have influenced Championniere as well as others to sacrifice the testicle, has been the idea that by so doing a radical cure of the accompanying hernia would be more certainly effected. However, Championniere's own statistics as well as those of other men, have shown that the herniæ remained cured in practically all cases without regard to whether or not the testicle has been removed. Hence, such reason for orchidectomy no longer obtains.

Championniere believes that a hernia practically always accompanies ectopia of the testicle of whatever variety and adds that although he performed two operations for ectopia without finding a hernia, one of these was an old operation and his not finding the hernial sac may have been due to inexperience. My own experience is entirely in harmony with this view. In not a single case of my entire series, 126 in number, did I fail to find a hernial sac.

Büdinger, one of the most recent writers upon the etiology of the undescended testis, states that he has operated upon 24 cases of inguinal retention of the testicle and that mechanical obstruction of some sort was found to be the cause of the nondescent of the testicle in 15 of these cases. A certain number of anatomical investigations upon cadavers confirmed the result.

FIG. 1.

Rare type of undescended testis, with hernial sac and cord extending to bottom of scrotum. Testis arrested at external ring.

One of the latter, a man 40 years of age, was brought to the hospital with cryptogenic pyæmia of which he died. Autopsy revealed the following conditions: The connective tissue of the scrotum proved absolutely normal; the hernial sac and tunica vaginalis propria were found loosely embedded; nowhere was there a structure that could in any way be brought in connection with a gubernaculum. The tunica vaginalis propria was greatly thickened, the sac elongated upward into the shape of a diverticulum. A band extended from the upper portion of the tunica vaginalis along the outer side of the testicle and epididymis, in its lower portion becoming one, partly with the tunica vaginalis, partly with the epididymis.

Büdinger states that while cicatricial adhesions between testicle and epididymis and intestines are given as one of the causes of retention by all authors, his experience has shown him that, though often seen, these phenomena are much less frequent than those peritoneal changes which, while having no direct connection with the gland, nevertheless interfere in an unequivocal manner with the motility of the testicle. He believes the adhesions of the testicle itself to represent an accidental localization of an extensive inflammatory process, rather than a cause in itself of the retention of the organ, and that cicatricial retraction of the peritoneum after inflammatory processes that take place prenatally or in earliest infancy, in the neighborhood of the inguinal canal, using up large areas of peritoneal covering, are a far more frequent cause of retention of the testicle. An undescended testis may prove an abnormally long cord, as shown by Fig. 1.

One of the most valuable of recent contributions to our knowledge of the undescended testis is the paper by Odiorne and Simmons (ANNALS OF SURGERY, Dec., 1904.) This paper is based upon a careful study of 77 cases observed at the Massachusetts General Hospital from 1877 to 1904. Inasmuch as orchidectomy was frequently employed, the microscopical study of the testicles removed has added considerable to our knowledge of the pathology of the undescended testis. It was shown that the tunica albuginea was more or less thickened in all the specimens examined, two being "five times thicker than the normal organ," and the interlobular connective tissue, while varying in amount, was generally increased. One of the most striking features of the unde-

scended testis was the "interstitial cells," which were found in all cases and generally in large numbers. These cells, while present in children in whom the testicles have normally descended, are not found in the adult organ. Their function is largely a matter of conjecture. According to Monod and Arthaud they are more often seen in the neighborhood of blood vessels. The specimens described by Odiorne and Simmons exhibited no definite relation to any structure of the testis; they were endothelial in type and of large size, with rounded nuclei.

The undescended testis shows another variation from the normal in the thickening of the basement membrane of the tubules. The epithelial lining of the tubules also shows very marked changes, the epithelial cells being few in number and more or less degenerated and irregular in shape. The so-called Reinke[1] crystals are usually seen in the interstitial fibrous tissues of the undescended testis. The nature and function of these crystals has as yet not been fully determined.

As regards treatment, no uniform method was employed, as the 77 cases were under the care of 15 different surgeons during the period of 27 years. In 28 cases orchidectomy was practised. Of these 17 were performed since 1900, 5 of which were in children, *i.e.*, in cases under 16 years of age. In four cases the testis was reduced into the abdominal cavity. In only 18 cases, 11 adults and 7 children, between 5 and 13 years of age, was orchidopexy performed, or an attempt made to bring the testis into the scrotum.

A perfect result was obtained in only 2 instances of the 7 children; this was in a patient with double retention; in 2 others the result was satisfactory, the testicle having remained in the upper portion of the scrotum. Of the 11 operations done upon adults between 16 and 42 years, 5 remained in the scrotum, one in perfect position, three retracted soon after operation into the canal, where they remained much atrophied; one is the cause of considerable pain. Two retracted into the

[1] Arch. f. mikr. Anatomie, 1896, p. 34.

pubic region, where they were the source of considerable annoyance, owing to their position.

This analysis suffices to prove that at present there is no definitely settled procedure of dealing with the undescended testis. There is agreement neither as to the proper age of interference nor as to the method of operation.

For many years—a century or more—it has been an almost universally accepted opinion that the undescended testis is peculiarly liable to undergo sarcomatous degeneration (Hunter, Godard, Curling).

McAdam Eccles (1903 Jacksonian Prize Essay) was the first to seriously question this opinion. He stated that close examination of upwards of 48,000 males with hernia, at the London Truss Society showed 854 cases of imperfectly descended testis, or about 2 per cent. In this series there was not a single example of sarcoma of the undescended testis. Furthermore, in 40 cases of sarcoma of the testis observed in one of the large London hospitals during a period of 20 years, there was only one case of sarcoma of the undescended testis. From these and other facts, he concluded that the generally accepted opinion could not be substantiated.

Since the publication of McAdam Eccles' paper, Odiorne and Simmons (ANNALS OF SURGERY, Dec., 1904) incline to accept the older opinion, in favor of which they cite 54 cases of malignant disease of the testis observed at the Massachusetts General Hospital during a period of 26 years. Of these 6, or 11 per cent. occurred in the undescended testis. They further state that Schödel, quoted by Von Kahlden, has reported 41 cases of sarcoma of the testis observed in a large London hospital in one year, of which 5, or 12 per cent. occurred in the undescended testis. This latter statement is clearly incorrect, since sarcoma of the testis is too rare a condition to be observed 41 times in a single hospital in one year.

McAdam Eccles states that among 4,200 male patients admitted annually to a large London hospital, there has been only an average of 2 cases of sarcoma of the testis during a period of 20 years.

Our observations at the Hospital for Ruptured and Crippled are quite in harmony with the facts related by McAdam Eccles. Since 1890 59,235 cases of hernia in males have been observed, in only 737 of which an undescended or maldescended testis was found, and not a single case of sarcoma of the undescended testis.

Personally, I have observed 34 cases of sarcoma of the testicle. The first 25 all occurred in normally descended testes, in the 26th and 27th and 34th cases the sarcoma developed in an undescended testis; all were examples of abdominal ectopia. This would make 8.8 per cent. of sarcomas of the testis originating in the undescended organ.

While the facts submitted by Eccles as well as the statistics at the Hospital for Ruptured and Crippled do not fully justify his conclusion (for the reason that a patient with a sarcoma of the undescended testis would not necessarily go to a hernia clinic, but to a general hospital) it is probably true that the danger of the undescended testis from the development of sarcoma is much less than has generally been supposed. It should be noted that the danger is much greater in abdominal than in the other varieties of ectopia.

Many surgeons have advised operation in the very young children, *e.g.*, 2 years of age or even younger. Such practice ignores the fact that in a large proportion of cases of undescended testis in young children, the organ will reach the scrotum by the age of puberty without surgical interference. In just what proportion of patients the undescended testis finally reaches the scrotum, has never been determined, I am at present engaged in tracing a large series of non-operated cases observed from 5 to 15 years ago.

That this is true is shown by the study of the statistics of any large hernia clinic. Of 739 cases of undescended testis observed at the Hospital for Ruptured and Crippled, since 1890, 561 occurred in 18,410 children under the age of 14 years, or 3 per cent; while only 92 cases occurred in 3,848 between the ages of 14 and 21 years, or 2.2 per cent.; and only 75 cases in 37,370 over 21 years of age, or .2 per cent.

That is, under the age of 14 years undescended testis is 15 times more frequent than after the age of 21 years.

Inasmuch as only comparatively few cases have been cured by operation during this period, the only conclusion is that the majority of undescended testes seen in infancy and early childhood eventually reach the scrotum through natural causes before the age of 14 years. Still another reason for deferring operation is the fact that the results of operations performed between the ages of 12 and 14 years are far better than those of an earlier age. One reason advanced in favor of early operation is that hernia associated with undescended testis is far more liable to strangulation. This assumption I believe to be incorrect, and not supported by facts. We have never observed a case of strangulation of a hernia with undescended testis at the Hospital for Ruptured and Crippled.

The results of the treatment of the undescended testis in France, as brought out at the Congress of Surgery in 1906, were as follows:

Villard reported 116 operations, with 56 perfect results, 42 doubtful ones and 18 failures. He stated that as a result of operation there is usually decrease of pain and increase of the virility of the individual, but the influence upon spermatogenesis is practically nil.

Kermisson, of Paris, reported 80 operations for undescended testis from 1898 to 1905, without any serious complications. Thirty-nine were examined as regards late results. Of these the testis was found in the scrotum in 15 cases; in ten at the root of the scrotum; in 9 at the orifice of the inguinal canal. In 2 or 3 cases only was the testicle well developed. In 10 cases associated with hernia, Bassini's operation was performed.

De Page reported 20 cases, of which 5 were double. Ten were traced, and in 7 of these the testicle was found in its normal position; in three others the testicle had retracted toward the external ring.

As regards the indication for operation, Villard would

not operate upon the abdominal variety of ectopic testis, for the reason that the operation is dangerous and the result uncertain. In simple cases, not complicated with hernia, he advised non-interference under the age of 10 years, and then closing the canal by Bassini's method.

While some of the surgeons advised operation in childhood as early as the second or third year, *e.g.*, Girard, the weight of opinion was in favor of postponing the operation until at least the fifth or sixth year and some until the age of ten, *e.g.*, Villard and Kermisson.

Broca's results still remain the most complete and most comprehensive (Bulletin Soc. de Chir. 28, 1902, p. 761). He reported 138 operations for inguinal ectopia associated with hernia, all cases occurring in children. Sixty-two patients with 79 operations were examined at periods of one year and upward after operation. Thirty-one showed perfect results; 35 fairly good results. Thirteen cases may be classed as failures as regards the testis remaining in position, although there was no return of the hernia. In all of these cases the testis showed more or less atrophy and in most of the cases the atrophied testis had retracted to the neighborhood of the external ring, or in some cases into the canal itself.

METHODS OF OPERATION.

The various methods of operation may be classified as follows: (1) Freeing the testicle and cord, with suture of the testis to the scrotum itself (Wood, Nicoladoni, Horsley); (2) freeing the testicle and anchoring it to the testis on the opposite side (Tuffier, Championniere, Sébileau); (3) cutting away all the structures of the cord except the vas and its vessel, then anchoring the testicle in the scrotum by placing the testis in the scrotum with or without suture (Mignon and Bevan). Suturing the cord to the tissues forming the external ring (Rieffel).

A number of other methods have been proposed, though not extensively followed, *e.g.*, pushing the testicle through an opening in the scrotum and burying it in the tissues of the

thigh temporarily, later returning it to the scrotal cavity (Keetley). Most surgeons, with the exception of Broca, close the inguinal canal by Bassini's method. Bevan was one of the first to recognize the disadvantages of this method of closure, inasmuch as a gain in length of the cord of ½–1 in. or more may be obtained by not transplanting the cord, bringing it out at the lower angle of the wound (modified Bassini).

The method of operation which I have employed has been: Bassini's incision, freely opening the aponeurosis of the external oblique as high up as possible, surrounding the cord and hernial sac, which latter has always been found present. Grasp the lower portion of the tunica vaginalis and by traction bring the testicle as far down as possible. Next, separate the sac from the cord, high up, just outside the internal ring. (In children this requires very careful and delicate dissection, as the cord is usually greatly enlarged and spreads out in a fan-like manner over an area of the sac 1–2 in. in size.) If the dissection has been begun at the right layer, the sac can be isolated and is then tied off as high as possible. In most cases of inguinal retention the cord can then be freed sufficiently to permit the testicle to be brought at least into the upper portion of the scrotum, in most cases into the lower part, with the sacrifice of but few, if any, of the veins. Except in a very few of the early cases, I have never made any attempt to anchor the testis in the scrotum, but rely upon careful freeing of the cord high up. Suturing of the testicle within the scrotum is, in my opinion, of little value. If there is any tension, the scrotum is retracted up toward the external ring. The canal is then closed by the modified Bassini method, *i.e.*, the cord is brought out at the lower end of the wound; the internal oblique is then sutured to Poupart's ligament over the cord. Great care is taken in placing the lowermost suture, which should include the reflected portion of the external oblique as well as the conjoined tendon and Poupart's ligament on the outer side. This suture, when tied, makes but a very small external ring, too small ever to permit the testis to retract into the canal, even should it reach the ring.

Bevan in 1899 and later in 1903 (Jour. Am. Med. Ass'n.) described a new method of operation for the undescended testis and strongly urged the more general employment of surgical treatment for this condition. His method consists in brief in a free opening of the canal by Bassini's incision of the skin and aponeurosis; cutting off the hernial sac high up beyond the internal ring; cutting away all the fascia and muscular fibres that hold the cord and testicle fixed in the canal; passing the finger into the iliac fossa and stripping the vas deferens from the peritoneum by means of blunt dissection, even sacrificing the veins and spermatic artery, if necessary to secure sufficient motility of the testis, to permit of its being brought into the scrotum without suture. The canal is then closed by the modified Bassini method, without transplantation of the cord. The external ring is carefully sutured to prevent the testicle from again entering the canal, should retraction take place.

Up to 1903 Bevan had operated upon 20 cases, although the late results of these cases are not given. He advises operation in all cases in which the testis can be palpated and believes the most favorable age of operation to be between the sixth and twelfth year.

CASES OF MALDESCENDED HERNIA OF SPECIAL INTEREST.

(A) *Inguinoperineal Hernia.*

CASE I.—J. M., aged 27 years; congenital, right side. Operation in 1895, at the Post-Graduate Hospital. A tumor the size of a child's head occupied a large pouch made of the dilated skin of the peritoneum and extended to the margin of the anus. (Fig. 2.) The right scrotum was empty and atrophied; testicle at the bottom of the hernial sac. A regular Bassini incision was made and the pouch found to contain small intestine omentum and the testis. On reduction of the contents, the testis was found at the bottom of the sac in the peritoneum and greatly atrophied. The testis and cord were removed and the wound closed by Bassini's method. No relapse of the hernia one year later, at which time the patient was drowned.

FIG. 2.

Inguinoperineal hernia (case I) from photo.

FIG 3.

Inguinoperineal hernia (Case VI).

CASE II.—W. G., aged 17 years; congenital, right inguinal hernia with perineal ectopia. Operation in 1901 at the General Memorial Hospital. The hernial sac was found to communicate with the abdominal cavity and, at the bottom of this, in the perineum about one inch from the margin of the anus, was the testis, almost normal in size. The regular Bassini incision was made in this case as in the preceding and the upper portion of the sac was removed and tied off flush with the abdominal cavity; a sufficient amount of the lower portion was left to furnish a new and complete covering to the testicle; it was united with purse-string suture. The testis was then transplanted into a pouch in the scrotum made by digital dilatation. Examination six years later showed the testis occupying a normal position in the scrotum and normal in size.

CASE III.—A. S., aged 35 years. The patient had noticed the hernia for only six years and had worn a truss the entire time. Operation July, 1896. The right scrotum was found to be empty and the testis which was atrophied to half normal size, was found in the anterior portion of the perineum. In this case the testis was not transplanted into the scrotum; wound closed by Bassini's method. Examination 5 years later showed the testis still occupying the anterior perineal region, no further atrophied.

CASE IV.—Infant, aged 7 months; left inguinoperineal hernia, sliding hernia of the sigmoid. Operation was undertaken at this early age for the reason that it was impossible to control the hernia by any form of truss. The operation was done at the Hospital for Ruptured and Crippled in Jan., 1908. The testis was found in the mid-perineum and normal in size; it was transplanted into the scrotum. The hernia was reduced and the wound closed by Bassini's method.

CASE V.—W. C., 16 years of age, had noticed a swelling in the right groin since a few days only. Physical examination shows the testis in the right mid-perineal region, a hernia in the canal, which, however, does not enter the perineal region. Operation Aug. 27, 1896, at the Post-Graduate Hospital. Bassini's incision for inguinal hernia. A small hernia sac is found extending down nearly to, but not communicating with the tunica vaginalis, which contained some bloody fluid in its cavity. The testis was found occupying the mid-perineal region and could be

pushed back almost to the anal margin. The right scrotum was empty and flat; the testicle and tunica vaginalis were dissected out from the perineum and transplanted into the scrotum in normal position. The inguinal canal was closed by Bassini's method. Examination 4 months later showed the testis of normal size, in the bottom of the scrotum.

CASE VI.—A. D., aged 29 years, admitted to the General Memorial Hospital in April, 1907, with a history of having had a swelling in the right mid-perineal region since childhood, which had given him considerable trouble of late in sitting and walking; the right scrotum had always been empty. Examination showed the right testicle occupying the mid-perineal region with the physical signs of an inguinal hernia passing down to the region of the testis. (Fig. 3.) Operation was performed in April, 1907. The testis was found to be normal in size; the hernial sac which communicated with the tunica vaginalis, was removed high up. Sufficient peritoneum was left to make a complete covering for the testis. The testis and cord were then transplanted into a pouch made by manual dilatation in the right scrotum. The wound was closed by the modified Bassini method, not transplanting the cord. The patient came to see me again in October. Examination at this time showed the testis had again retracted into the perineal region. I did a second operation, without opening the inguinal canal, brought the testis to the bottom of the scrotum and there sutured it with catgut. The testis has remained in perfect position since, the last examination having been made on March 28, 1908, six months later.

CASE VII.—T. E., aged 40 years. Right inguinoperineal hernia since infancy. Operation General Memorial Hospital, 1902. Testis transplanted into scrotum. Hernia wound closed by modified Bassini operation. Examination 5 years later showed testis in normal position. Testis slightly atrophied at time of operation, no further atrophy.

CASE VIII.—M. H., aged 5 years. Left inguinoperineal hernia. Operation Hospital for Ruptured and Crippled, November 15, 1895. Testis found in anterior portion of perineum, with hernial sac communicating with tunica vaginalis. Testis transplanted into scrotum. Wound closed by Bassini's method. Examination 8 years later showed testis in normal position; no atrophy.

FIG. 4.

CASE X. Inguinosuperficial hernia with bilocular sac. Strangulated omentum. No hernia ever noticed prior to strangulation.

CASE IX.—F. E., aged 40 years, had noticed swelling in the right perineal region since childhood. Operation at the General Memorial Hospital Oct. 1, 1902. Bassini's incision for inguinal hernia. The right testis was found in the mid-perineal region, the tunica vaginalis communicating with a large hernial sac which contained a mass of irreducible omentum. This was tied off in small sections and the stump reduced into the abdominal cavity. The testicle was transplanted into the right scrotum. Examination May 6, 1907, showed the result perfect.

In addition to the preceding cases, I have observed at the Hospital for Ruptured and Crippled since 1890, six other cases of perineal ectopia which were not operated upon. Whether or not the ectopia was associated with a hernia could not be determined without operation. One, aged 5 years, left side; another aged 21 months, right; a third aged 7 months, right side. The other three cases were in adults.

(B) *Inguinosuperficial Hernia With Undescended Testis.*

CASE X.—*Inguinosuperficial hernia with bilocular sac.*—That a diverticulum of peritoneum or hernial sac may occupy an unusual position irrespective of the action of the gubernaculum, is illustrated by the following case:

L. N., aged 30 years, was operated upon at the Post-Graduate Hospital, Feb. 25, 1897, for strangulated omental hernia of large size. The patient gave a history of having had no hernia nor even impulse on coughing prior to 24 hours before admission. While engaged in dancing a tumor appeared in the left iliac and scrotal region, about the size of a fist. It was very painful and could not be reduced. Nausea and occasional attacks of vomiting followed; but there was a small movement of the bowels. Physical examination showed a tumor occupying the upper scrotal region, extending up over the aponeurosis of the external oblique as far as the anterior superior spine. The whole tumor was completely dull on percussion. The diagnosis of strangulated omental hernia was made and immediate operation advised. On cutting through the skin a tumor was found emerging from the external ring, which was very tightly constricted and composed of two loculi, one passing down into the upper scrotum, the other upward, resting upon the aponeurosis of the external oblique. The

canal was first opened and then the sac, which was found to contain a large mass of deeply congested omentum, with several ounces of bloody serum; no intestine was present. (Fig. 4.) The testis was found to occupy the lower portion of the bilocular sac, the upper one containing only the imprisoned omentum. The patient made an uninterrupted recovery.

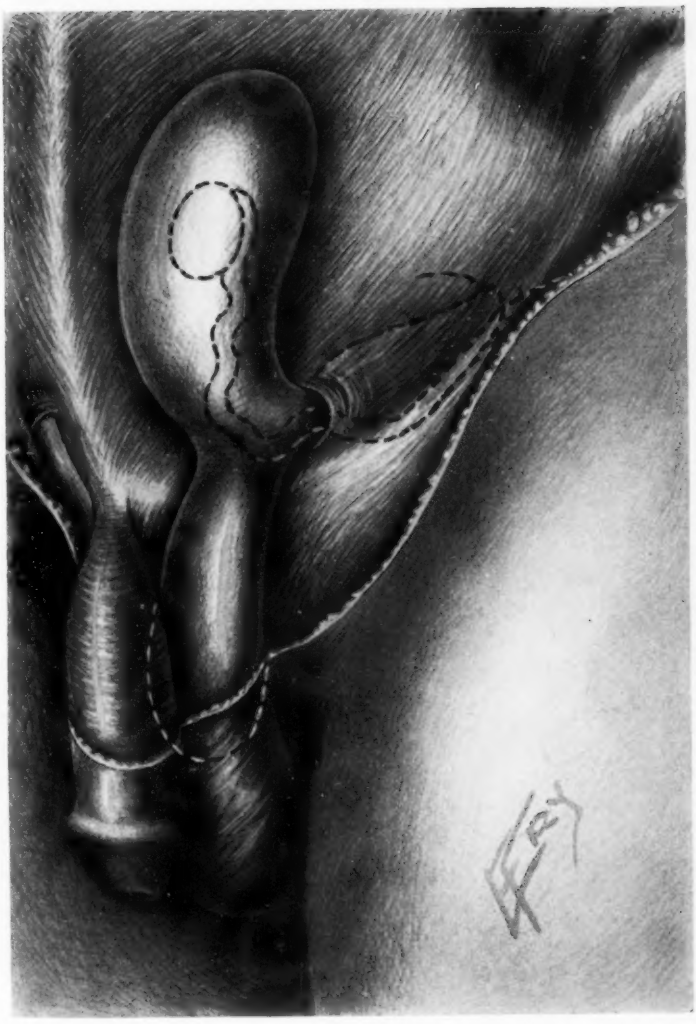
In this case we undoubtedly had to deal with a bilocular sac of congenital origin which had been entirely empty up to 24 hours prior to operation, when a mass of omentum was forced into the sac. The old explanation of such sacs being due to the gradual dilatation of a hernia prevented from passing downward by the testis, and following the line of least resistance upward, does not hold good in this case.

The recent investigations made by Murray, of Liverpool, who has examined 200 cadavers of adults who had had no history of hernia during life, showed that congenital diverticuli are by no means infrequently found in the femoral canal, he having found 47 such instances in the above series of examinations.

These facts, I think, enable us to explain perineal ectopia as well as the inguinosuperficial variety, as the result of an unusual prolongation of a peritoneal diverticulum, rather than the result of traction of a more or less imaginary fasciculus of the gubernaculum.

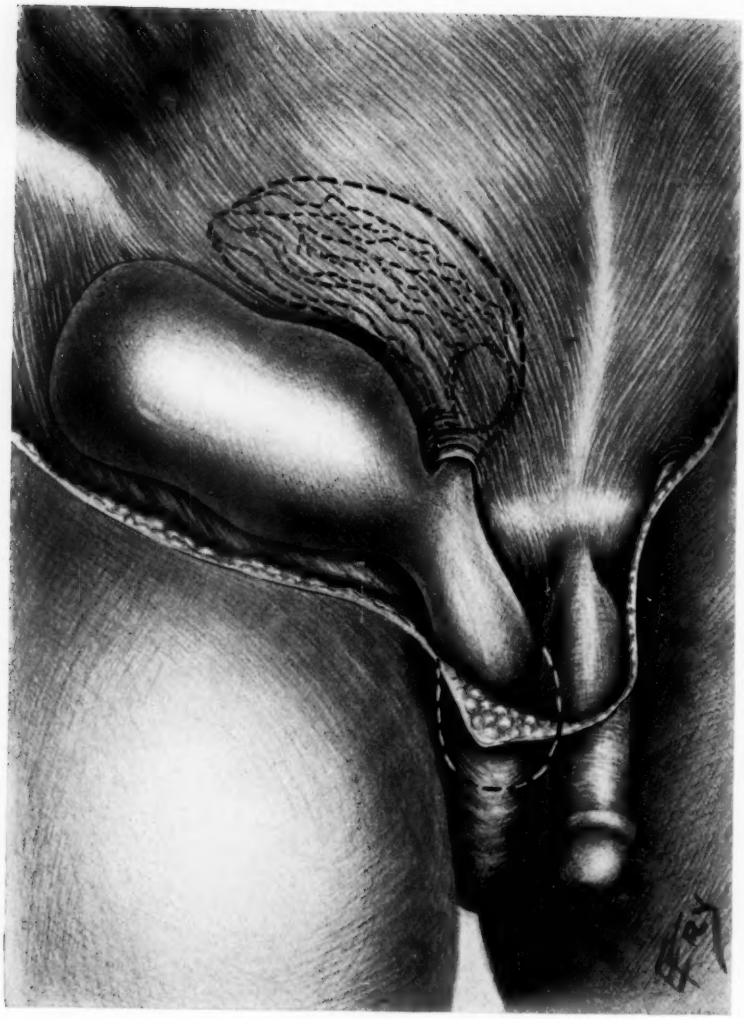
CASE XI.—*Inguinosuperficial hernia with trilocular sac.*—A. H., 24 years of age; right undescended testis with right inguinosuperficial hernia. The patient gives a history of the testis never having been felt on the right side; a swelling having been noticed for a number of years, often disappearing on lying down. Operation March 1, 1908, at the General Memorial Hospital. On making the usual incision for Bassini's operation for inguinal hernia, cutting through the skin and superficial fascia, an empty sac was found resting upon the aponeurosis of the external oblique, and extending nearly to the anterior superior spine. The right scrotum was empty and the external ring small. On splitting up the aponeurosis of the external oblique, a second interstitial sac was felt situated between the external and internal oblique, about 2½ in. in diameter. At

FIG. 5.



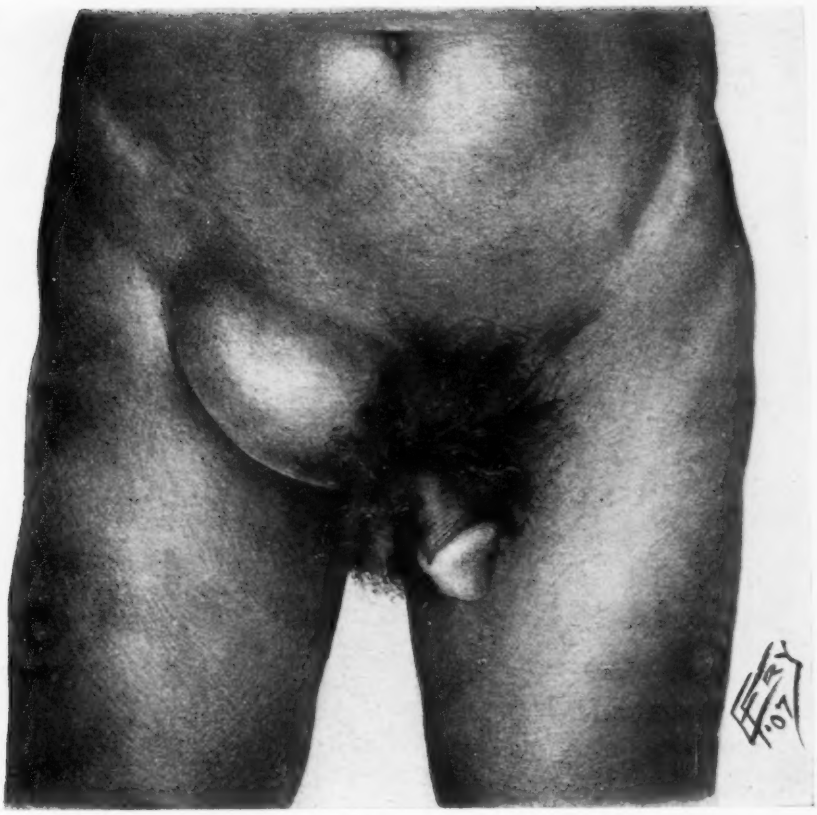
Inguinosuperficial hernia. Bilocular sac with testes in upper loculus.

FIG. 6.



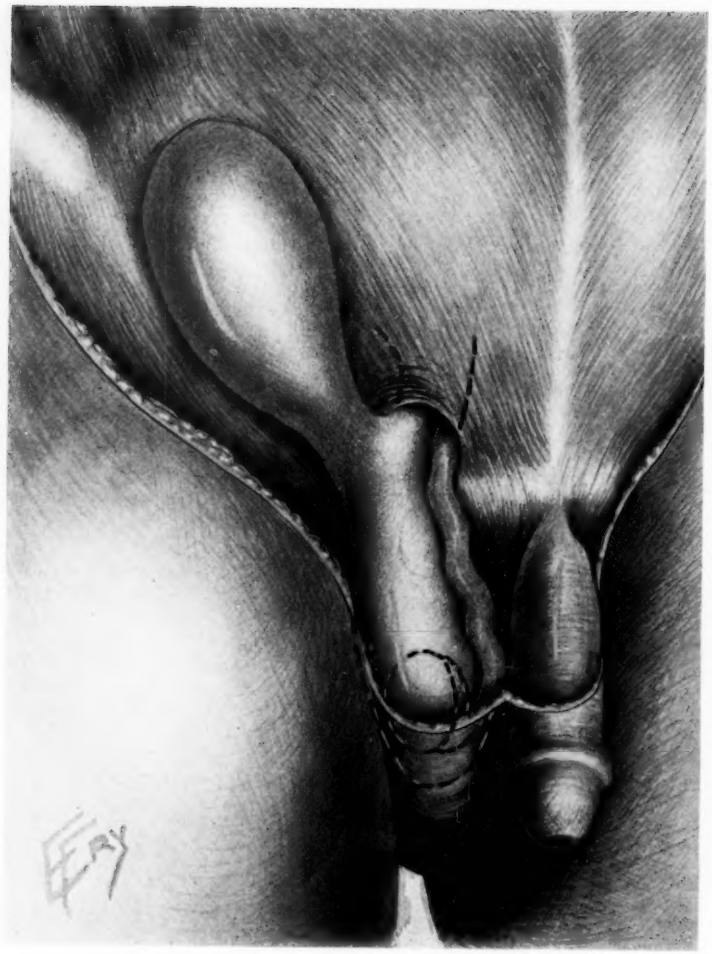
Inguinosuperficial and interstitial hernia with trilocular sac.

FIG. 7.



Inguinosuperficial hernia. From photo.

FIG. 8.



Inguinosuperficial hernia. Testis in upper scrotum.

the bottom of this sac, resting on the transversalis muscle and attached to the pubic bone, the testis was found. It was somewhat atrophied, being about two-thirds normal size. The internal ring was rather small and did not permit of the return of the testis into the abdominal cavity. There was still a third loculus of the sac communicating with the external and internal loculi and occupying the upper part of the scrotum. (Fig. 6.) This was empty. A portion of omentum, about 3 in. long, about the size of the little finger occuped the inner sac and at its distal end was adherent to the testis. This was removed. The peritoneum was tied off well above the internal ring and sufficient left to make a perfect covering for the testis. The cord was thoroughly freed and the testis brought into the lower part of the scrotum without much tension. The wound was closed by the modified Bassini method, without transplanting the cord.

The inguinosuperficial variety of hernia (Figs. 7 and 8) has been regarded as an extremely rare type. Moschcowitz (Med. Rec. Vol. LXIII, p. 62, 1903) in reporting a case, stated that only 17 were recorded in the literature.

This type of hernia has already been described by Macready and Küster, and up to recently, very few cases have been reported. That the condition is much more common than has been recognized, is shown by the statistics at the Hospital for Ruptured and Crippled, as well as by my own cases operated upon elsewhere. Personally I have operated upon 25 cases, 10 adults and 15 children. The adults were between 16 and 33 years of age; the children between 5 and 13 years. In all but two cases the testis was either found in the superficial sac resting on the aponeurosis of the external oblique, or it could be made to enter this sac on coughing. In 2 cases, already referred to, the testis had evidently never occupied the external sac (vide Case X).

This type of ectopia I believe to be due to the fact that the vaginal process of the peritoneum has, for some unknown reason been turned upward upon the external oblique instead of taking its normal course into the scrotum.

The treatment of this variety of maldescended testis is extremely satisfactory, for the reason that in most cases the cord is sufficiently long to enable the operator to bring the testis into the scrotum with little or no tension.

CASE XII.—*Unusual type of abdominal ectopia* (see Fig. 9). The patient, aged 17 years, with double undescended testis, was operated on April 18, 1908, at the General Memorial Hospital. On palpation it was thought that an atrophied testis could be felt on the right side, but operation showed an empty vaginal process extending into the scrotum. The bottom of this process was thickened into folds which gave the feeling of an atrophied testis. On the outside of the vaginal process or sac, posteriorly, exactly corresponding to the cord and its vessels in the normal condition, there were a number of vessels, arteries and veins which made up a false cord. These vessels became lost at the bottom of the sac. The testis itself, fully developed, was found in the abdominal cavity, was brought out and by carefully freeing the peritoneal and muscular bands was brought into the bottom of the scrotum.

ANALYSIS OF CASES.

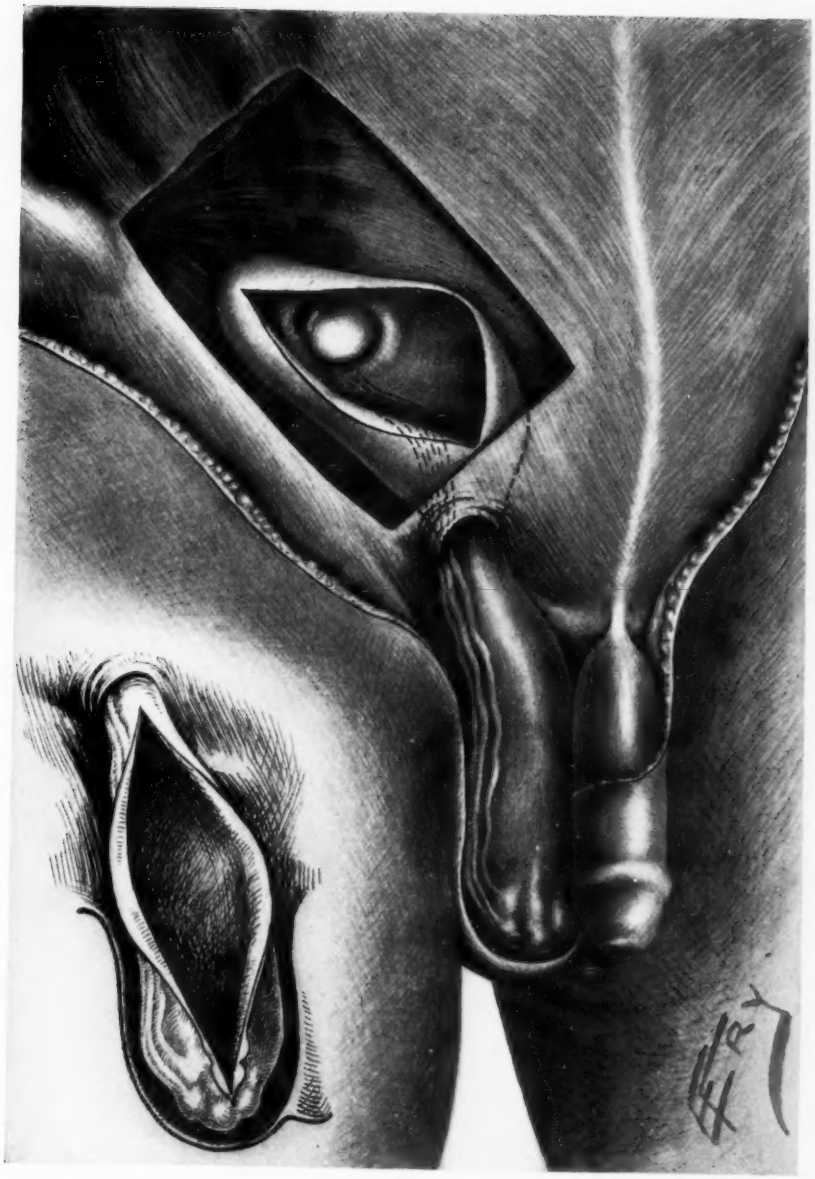
This series of cases comprises 128 operations. Of these 25 represented an ectopia of the inguinosuperficial type, with the testis and sac resting upon the aponeurosis of the external oblique. There were 9 cases of the inguinoperineal type, the sac and testis occupied the perineal region.

There has been no recurrence of the hernia in a single only two cases was the testis sacrificed. In both the patients were adults and in one a small atrophied testis was found in the bottom of the sac of a very large inguinoperineal hernia. The other case was one of abdominal ectopia, in which the testis could not be brought outside of the external ring.

There has been but one recurrence of the hernia. Seventy-two cases have been traced from 1 to 15 years with the following results: 52 children were traced from 1 to 15 years, 17 less than one year, 15 not traced; of 44 adults, 19 were traced 1 to 10 years, 4 traced less than 1 year, 21 not traced.

Results in Adults.—Of 19 adults examined from 1 to 10 years after operation the testis was found in good position in

FIG. 9.



CASE XII. Abdominal ectopia with false cord extending to the bottom of the scrotum, where it ended.

the scrotum in 8 cases and at the external ring or not stated in the others.

One case deserves special mention, inasmuch as it shows the probable influence of the operation upon epilepsy:

The patient, aged 25 years, was operated upon 5 years ago, for right undescended testis of the inguinal type. The testis was brought into the scrotum and has remained in good position ever since. At the time of the operation he stated that he had been subject since childhood to epileptiform seizures, the attacks occurring frequently, often within 1 to 2 weeks. In a letter received January, 1908, he states that he has never had a single attack since the time of the operation. The patient was presented before the New York Surgical Society at the time the paper was read.

Results in Children.—Testis in scrotum in 11 patients; testis outside of external ring in 15 patients and in canal or not felt in 4. The following cases illustrate the results in some of the patients traced for a considerable period of time:

CASE 1, aged 13 years at the time of operation. Examination 13 years later, shows the testis atrophied and resting just outside of the external ring.

CASE 2, aged 13 years at the time of operation. Letter 13 years later, states the testis is normal and in the scrotum. Patient is married and has one child.

CASE 3, aged 8 years at the time of operation. Examination 4 years later shows testis atrophied, just outside the external ring.

CASE 4, aged 5 years; inguinoperineal type operation. Testis in scrotum 8 years after operation.

CASE 5, aged 6 years at the time of operation. Testis just outside the external ring, 7 years later; no atrophy.

CASE 6, aged 5 years at the time of operation. Testis just outside the external ring, 5 years later.

CASE 7, aged 9 years at the time of operation. Testis in scrotum, full size, 9 years later.

CASE 8, aged 12 years at the time of operation. Testis fully descended; examination 7 years later.

CASE 9, aged 10 years at the time of operation. Testis in normal position; no atrophy; examination 5 years later.

CASE 10, aged 13 years at the time of operation. Double, undescended testis, superficial inguinal kind. Operation, 1905. Examination 2 years later shows both testes of normal size, in the upper part of the scrotum.

TABLE OF CASES OF UNDESCENDED AND MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA. TREATED BY OPERATION. 1893 TO 1908.—(A) SECTION OF CHILDREN.

No.	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
1	V. S.....	13	Right	Inguinal	Feb., '93	Testis brought into scrotum. Anchored by catgut suture	Bassini	Primary union	Examination 13 years later shows atrophied testis just outside external ring. Hernia cured.
2	G. R.	8	Left	Inguinal	1, 18, '93	Testis brought into scrotum. Anchored by catgut suture	Bassini	Primary union	Examination 4½ years later shows testis atrophied outside external ring.
3	J. O. C.	9	Left	Inguinal	6, 12, '94	Testis brought into scrotum. Anchored by catgut suture	Bassini	Primary union	Traced only 4 months.
4	M. C.	12	Right	Inguinal	1, 11, '95	Testis brought into scrotum. Anchored by catgut suture	Bassini	Primary union	Examination 13 years later shows testis normal. Patient married; has one child.
5	M. H.....	5	Left	Inguino-perineal	11, 15, '95	Testis transplanted to scrotum. Cord normal length	Bassini	Primary union	Traced 8 years after operation. Normal.
6	G. G.	6	Right	Inguinal	3, 27, '96	Testis brought outside external ring. Could not be made to reach scrotum	Bassini	Primary union	Examination 7 years later. Testis outside external ring; not atrophied.
7	T. W.....	10	Left	Inguinal	3, 27, '96	Testis brought into upper scrotum	Bassini	Primary union	1 year later. Well.
8	D. M.	9	Right	Inguinal	7, 31, '96	Testis atrophied. Placed in upper scrotum	Cord not transplanted (modified Bassini)	Primary union	Testis just outside external ring 5 years later.
9	R. B.....	9	Left	Inguinal	5, 21, '97	Testis brought into sac	Bassini	Primary union	Testis could not be felt 6 months later.
10	H. C.	14	Left	Inguinal	7, 30, '97	Testis brought outside external ring	Bassini	Primary union	Well 7 years later.
11	M. G.	7	Left	Inguinal	10, 29, '97	Testis brought into upper scrotum	Bassini	Primary union	Traced 1 year.
12	J. M.....	9	Left	Inguinal	6, 17, '98	Testis brought into scrotum	Bassini	Primary union	Traced 4 years.
13	W. T..... ..	9	Left	Inguino-superficial	9, 2, '98	Testis brought into scrotum	Bassini	Primary union	Traced 1 year.
14	O. S.....	11	Left	Inguinal	10, 7, '98	Testis brought beyond external ring	Bassini	Primary union	Traced 2 years.

15	J. M..... ...	5	Right	Inguinal	10, 14, '98	Testis brought beyond external ring	Bassini	Primary union	Traced 7 years. Testis atrophied just outside external ring.
16	H. M..... .	9	Right	Inguinal	11, 4, '98	Testis brought beyond external ring	Bassini	Primary union	Traced 8 years. Testis in bottom of scrotum same size as other.
17	S. P..... .	7	Right	Inguinal	7, 21, '99	Testis brought beyond external ring	Bassini	Primary union	Traced 8 years. Testis atrophied outside external ring.
18	W. A..... .	11	Left	Inguinal	8, 4, '99	Testis brought beyond external ring	Bassini	Primary union	Traced 4 years. Testis upper scrotum normal size.
19	W. W..... ..	11	Right	Inguinal	3, 30, '00	Testis brought beyond external ring	Bassini	Primary union	Traced 6 years. Testis just outside external ring.
20	A. S.....	4	Right	Inguinal	5, 18, '00	Testis brought beyond external ring	Bassini	Primary union	Traced 5 years.
21	I. G.	12	Right	Inguinal	7, 13, '00	Testis brought beyond external ring	Bassini	Primary union	Traced 7 years; fully descended normal testis.
22	J. H.	10	Right	Inguinal	8, 3, '00	Testis brought into upper scrotum	Bassini	Primary union	Traced 2 years.
23	L. H.	9	Right	Inguinal	8, 10, '00	Testis brought into upper scrotum	Bassini	Primary union	Traced 8 years. Testis outside external ring size of hickory nut.
24	B. C..... ..	7	Left	Inguinal	9, 14, '00	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
25	H. W.	11	Left	Inguinal	6, 7, '01	Testis brought into upper scrotum	Bassini	Primary union	Traced 7½ years. Testis external ring.
26	J. S.	10	Right	Inguinal	1, 3, '02	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
27	A. W..... ..	12	Left	Inguinal	1898	Testis brought into upper scrotum	Bassini	Primary union	Traced 10 years. Testis in canal.
28	J. L.	8	Left	Inguino-superficial	2, 14, '02	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
29-30	O. H.	10	D'ble	Double inguino-superficial	3, 20, '02	Both testes brought into lower scrotum. Cord normal length	Bassini	Primary union	Traced 5 years. Testis in good position.
31	M. V. H.....	...	Right	Inguinal	6, 27, '02	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
32	J. B.	8	Right	Inguino-superficial	9, 5, '02	Testis brought into upper scrotum	Bassini	Primary union	Traced 5½ years. Well.
33	R. K.	10	Left	Inguinal	9, 5, '02	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
34	A. H.	5	Right	Inguinal	1, 9, '03	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
35	L. K.	5	Left	Inguinal	1, 23, '03	Testis brought into upper scrotum	Bassini	Primary union	Traced 8 months.
36	J. F.	9	Right	Inguinal	4, 10, '03	Testis brought into upper scrotum	Bassini	Primary union	Not traced.

TABLE OF CASES OF UNDESCENDED AND MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA. TREATED BY OPERATION. 1893 TO 1908.—SECTION OF CHILDREN.—*Continued.*

No.	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
37	J. S.	7	Left	Inguinal (interstitial sac)	4, 20, '03	Testis brought into upper scrotum	Bassini	Primary union	Traced 4 years. Testis not felt.
38	M. L	8	Left	Inguinal	5, 1, '03	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
39-40	J. C.	11	D'ble	Inguinal	5, 1, '03	Testis brought into upper scrotum	Bassini	Primary union	Traced 4 months.
41	R. S.....	9	Right	Inguinal	5, 29, '03	Testis brought into upper scrotum	Bassini	Primary union	Traced 4 years.
42-43	W. T..... ..	12	D'ble	Inguinal	10, 30, '03	Testis brought into upper scrotum	Cord not transplanted on either side	Primary union	Traced 4 years.
44	H. W.	11	Left	.....	10, 30, '03	Testis brought into lower scrotum without tension	Cord not transplanted	Primary union	Traced 4 years.
45	O. H.	12	Right	Inguino-superficial (Traumatic) kick in groin	1, 22, '04	Testis placed in bottom of scrotum	Bassini	Primary union	Traced 9 months.
46	J. B.	7	Left	Inguino-superficial	2, 5, '04	Testis placed in bottom of scrotum	Bassini	Primary union	Traced 4 years. Testis not felt.
47-48	T. M.....	7	D'ble	Inguinal	2, 19, '04	Testes placed in scrotum	Bassini. Left cord not transplanted	Primary union	Hernia cured; both testes just outside external ring April, 8, 1908; 4 years testes about one-half normal size.
49	H. M.....	14	Left	Inguinal	4, 15, '04	Testis brought into upper scrotum	Bassini	Primary union	Not traced.
50	L. B.....	10	Right	Inguinal	3, 25, '04	Testis brought into upper scrotum	Bassini	Primary union	Traced 2 years.
51	C. S.....	6	Left	Inguinal	4, 22, '04	Testis brought into lower scrotum	Bassini	Primary union	Not traced.
52	M. M.....	8	Right	Inguinal (Putré) Testes join outside internal ring	9, 16, '04	Testis brought into upper scrotum	Cord not transplanted	Primary union	Traced 1 year.
53	S. I..... ...	13	Right	Inguinal	11, 4, '04	Testis brought into upper scrotum	Bassini	Primary union	Testis at external ring few months after operation.
54	A. S.....	12	Left	Inguinal	1, 13, '05	Testis placed in scrotum	Bassini	Primary union	Traced 3 years; good position
55	H. A.....	8	Right	Inguino-superficial	2, 17, '05	Testis placed in scrotum	Cord not transplanted	Primary union	Not traced.
56-57	H. S.	12	D'ble	.....	5, 15, '04	Testes brought into scrotum	Cord not transplanted either side	Primary union	Traced 1 year; both testes still in upper scrotum, not atrophied.

58	P. A.....	4	Right	Inguinal	3, 17, '05	Testis brought into scrotum	Cord not transplanted	Primary union	Traced 2 years.
59	J. F.....	6	Right	Inguinal. Testis at internal ring	4, 14, '05	Testis brought into scrotum	Cord not transplanted	Primary union	Traced 2 years.
60	G. L.	8	Left	Inguinal	9, 22, '05	Testis brought into scrotum	Bassini	Primary union	Not traced.
61-62	E. S. C.....	13	D'ble	Inguino-superficial	11, 23, '05	Both testes placed in bottom of scrotum	Bassini, both sides	Primary union	Traced 2 years; both testicles outside external ring, no atrophy.
63	H. B.....	12	Right	Inguinal	1, 26, '06	Both testes placed in bottom of scrotum	Cord not transplanted	Suppuration	Traced 2 years. Testis in bottom of scrotum.
64	F. W.....	6	Left	Inguinal	1, 20, '06	Both testes placed in bottom of scrotum	Cord not transplanted	Primary union	Died of scarlet fever while in hospital.
65	E. S.....	9	Right	Inguinal	2, 2, '06	Testes evenly placed in bottom of scrotum	Cord not transplanted	Primary union	Traced 1¾ years.
66	W. W.....	11	Left	Inguinal	2, 2, '06	Testes evenly placed in bottom of scrotum	Cord not transplanted	Primary union	Traced 6 months.
67	S. S.....	7	Left	Inguinal	2, 16, '06	Testes evenly placed in bottom of scrotum	Cord not transplanted	Primary union	Not traced.
68	A. L.....	6	Right	Inguinal	3, 16, '06	Testes evenly placed in bottom of scrotum	Cord not transplanted	Primary union	Traced 2 years. Testis outside external ring, April 2, 1908.
69	G. M.....	11	Right	Inguino-superficial	3, 30, '06	Testes evenly placed in bottom of scrotum	Cord not transplanted	Primary union	Traced 2 years. Testis just outside external ring.
70	W. W..... ...	4	Right	Inguino-superficial	4, 27, '06	Testes evenly placed in bottom of scrotum	Cord not transplanted	Primary union	Traced 1 year. Testis not felt.
71	R. L.....	11	Right	Inguino-superficial	3, 15, '07	Testes evenly placed in bottom of scrotum	Cord not transplanted	Primary union	Traced 1 year. Testis at external ring.
72	A. B.....	13	Right	Inguino-superficial	3, 15, '07	Testis brought into mid-scrotum	Cord not transplanted	Primary union	Traced 1 year.
73	E. H.....	12	Right	Inguino-superficial	3, 22, '07	Testis brought to bottom of scrotum	Cord not transplanted	Primary union	Not traced.
74	H. G.....	5	Right	Inguinal	4, 19, '07	Testis brought into scrotum	Cord not transplanted	Primary union	Traced 1 year.
75	P. Z.....	10	Right	Inguino-superficial	2, 15, '07	Testis brought into upper scrotum	Cord not transplanted	Primary union	Traced 1 year.
76	F. P.....	12	Left	Inguino-superficial, also femoral hernia	5, 3, '07	Testis brought into bottom scrotum	Cord not transplanted	Primary union	Traced 9 months.
77	V. B..... ..	7	Right	Inguino-superficial	5, 24, '07	Sac rested on external oblique up to anterior superior spine. Testis, ½ normal size, placed in scrotum	Cord not transplanted	Primary union	Not traced.
78	F. E	4	Right	Inguinal	5, 24, '07	Testis brought into bottom of scrotum	Cord not transplanted	Primary union	Traced 9 months. Testis in upper scrotum.

TABLE OF CASES OF UNDESCENDED AND MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA. TREATED BY OPERATION. 1893 TO 1908.—SECTION OF CHILDREN.—*Continued.*

No.	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
79	G. M.....	5	Left	Inguinal	6, 10, '07	Testis brought into bottom of scrotum	Cord not transplanted	Primary union	Well 10 months.
80	A. B.....	7	Right	Inguinal	6, 10, '07	Testis brought into bottom of scrotum	Cord not transplanted	Primary union	Traced only 2 months.
81	M. M.....	6	Left	Inguinal	1, 3, '08	Testis brought into bottom of scrotum	Cord not transplanted	Primary union	Well at present; 3 months.
82	J. B.....	7 m.	Left	Inguino-perineal. Irreducible	1, 10, '08	Testis transplanted from perineum into bottom scrotum. (Cong. Hernia sac)	Cord not transplanted	Primary union	Well at present; 4 months.
83	G. N.....	6	Right	Inguinal	1, 24, '08	Testis placed in upper scrotum	Cord not transplanted	Primary union	Well at present.
84	L. R.....	5	Left	Inguino-superficial	2, 21, '08	Testis placed in scrotum	Cord not transplanted	Primary union	Well at present.

TABLE OF CASES OF UNDESCENDED OR MAL-DESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA. TREATED BY OPERATION. 1893 TO 1908.—(B) ADULTS.

No.	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
85	M. G.....	25	Right	Canal	1900	Testis brought into scrotum	C. N. T.	Primary union	Well 1 year.
86	J. R.....	19	Right	Canal	1900	Testis brought into scrotum	C. N. T.	Primary union	Well 1 year.
87	Long	15	Right	Canal	1900	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
88	W. G.....	17	Right	Inguino-perineal	1901	Testis transplanted into scrotum	C. N. T.	Primary union	Well 6 years. Testis in lower scrotum, no atrophy.
89	J. T.	20	Left	Canal	1898	Testis brought into scrotum	C. N. T.	Primary union	Well 4 years. Testis external ring.
90	L. J.	17	Left	Canal	1898	Testis brought into scrotum	C. N. T.	Primary union	Well 6 years.

91	L. N.	30	Left	Inguino-superficial external ring bilocular sac	1898	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
92	J. M.....	27	Right	Inguino-perineal. Very long	1895	Testis atrophied. Removed	C. N. T.	Primary union	Well 1 year.
93	R.....	17	Left	Inguinal	3, 15, '06	Testis brought into upper scrotum	C. N. T.	Primary union	
94	C. D.	30	Right	Canal (epilepsy)	1903	Testis brought into scrotum	C. N. T.	Primary union	Well 5 years. Testis in scrotum; no further attack of epilepsy.
95	H. W.	30	Right	Inguino-superficial	1902	Testis brought into scrotum	C. N. T.	Primary union	1 year later testis outside external ring.
96	W. K.....	23	Left	Abdominal retention	1903	Testis brought to upper scrotum	C. N. T.	Primary union	Not traced.
97	C. S.....	28	Right	.....	1902	Testis brought into scrotum	C. N. T.	Primary union	Well 1 year.
98-99	G. D.	17	D'ble	Canal, both sides	1902	Testis brought into scrotum	C. N. T.	Primary union	1 year later both testes in scrotum.
100	T. E.	40	Right	Inguino-perineal	1902	Testis transplanted into scrotum	C. N. T.	Primary union	Testis in scrotum 5 years later.
101	S. S.....	20	Left	Inguino-superficial	1902	Testis brought into scrotum	C. N. T.	Primary union	
102	T. S.....	18	Right	Inguino-superficial	....	Testis brought into scrotum	C. N. T.	Primary union	
103	J. I.	33	.....	Inguino-superficial	1903	Testis brought into scrotum	C. N. T.	Primary union	
104	C. D.	29	Right	Inguino-perineal	1907	Testis transplanted into scrotum	C. N. T.	Primary union	Testis soon got back into perineum; second operation October, 1907, sutured in scrotum. Perfect result April, 1908.
105	W. C.....	16	Right	Inguino-perineal	1896	Testis transplanted into scrotum	C. N. T.	Primary union	Not traced.
106	A. S.....	35	Right	Inguino-perineal	1896	Testis transplanted into scrotum	C. N. T.	Primary union	Hernia recurred 1 year later.
107	H. L.	20	Left	Inguino-superficial	1905	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
108	T. G.	45	Left	Abdominal	5, 23, '06	Testis atrophied; removed. Could be brought only into canal.	C. N. T.	Primary union	
109	E. M.	25	Right	Inguino-superficial	1, 22, '06	Testis atrophied; removed. Could be brought only into canal.	C. N. T.	Primary union	Well 2 years later.
110	D. R.	38	Right	Canal	July, 06	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
111	G. C.....	22	Right	Inguino-superficial	11, 14, '06	Testis brought into scrotum	C. N. T.	Primary union	Not traced.

TABLE OF CASES OF UNDESCENDED AND MALDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA. TREATED BY OPERATION. 1893 TO 1908.—ADULTS.—*Continued.*

No.	Name	Age	Side	Position of testis	Date	Disposition of testis	Method of operation for hernia	Immediate result	Subsequent history
112	S. G.....	22	Left	External ring	4, 10, '07	Testis brought into scrotum	C. N. T.	Primary union	Not traced.
113	M. E.....	16	Left	Inguino-superficial. Bilocular sac	Apr., '07	Testis transplanted into scrotum	C. N. T.	Primary union	Not traced.
114	O. R.	30	Right	Canal	Feb., '06	Testis transplanted into scrotum	C. N. T.	Primary union	Not traced.
115	H. W.	20	Right	Inguinal	Feb., '06	Testis transplanted into scrotum	C. N. T.	Primary union	Not traced.
116	G. T.	14	Left	Inguinal	Aug., '04	Testis transplanted into scrotum	C. N. T.	Primary union	Well 3½ years. Testis increasing in size. Hernia cured.
117	B. A.....	23	D'ble	Left inguinal. Right abdominal	10, 20, '04	Left operation (Dr. Downs.) Right testis in abdomen not operated on	C. N. T.	Primary union	Not traced.
118-119	E. R.	16	D'ble	Inguinal	Nov.. '04	Testis brought into scrotum. (Op. Dr. Downs)	C. N. T.	Primary union	Right testis in scrotum two years later; left external ring.
120	S. M.	21	Left	Inguinal	Feb., '05	Testis brought into scrotum			
121	A. B.....	41	Right	Superficial inguinal	5, 4, '05	Testis brought into scrotum	C. N. T.	Primary union	Testis in middle scrotum March 27, 1908. nearly 3 years.
122	L. F.....	38	Left	Superficial inguinal	Oct., '05	Testis brought into scrotum	C. N. T.	Primary union	March 28, 1908, letter states slight relapse; no hernia.
123	F. C.....	22	Right	Superficial inguinal	11, 22, '05	Testis brought into scrotum	C. N. T.	Primary union	
124	J. C.....	16	Right	Canal	12, 6, '05	Testis brought into scrotum	C. N. T.	Primary union	Testis in bottom of scrotum; no atrophy 2¼ years later.
125	S.....	20	Right	Inguino-superficial	7, 19, '07	Testis brought into scrotum	C. N. T.	Primary union	No atrophy of testis.
126	A. H.	24	Right	Inguino-superficial and interstitial bilocular sac	3, 19, '08	Testis brought into scrotum	C. N. T.	Primary union	Well at present. Testis upper scrotum.
127	H. W.	17	D'ble	Abdominal	4, 16, '08	Right testis brought into upper scrotum. No operation on left side	C. N. T.	Primary union	Testis in scrotum.
128	J. B.	22	Right	Abdominal	4, 16, '08	Right testis brought into upper scrotum	C. N. T.	Primary union	Testis in scrotum.

CONCLUSIONS.

From my own observations as well as from a careful study of the reports of other surgeons, I believe the following conclusions are justified:

1. The undescended testis is almost invariably of little or no functional value. It often gives rise to considerable pain and is more subject to inflammatory attacks than the normally descended organ and, possibly (though this is by no means proven), is more subject to malignant changes.

2. The undescended testis should never be sacrificed in children and very rarely in adults, it having been proven possible to effect a radical cure of the hernia quite as well without the removal of the organ. In childhood the testis, even if it never attains any functional value, is nevertheless of value in developing the male characteristics of the child as well as in promoting his general health. In the adult, it should be retained for its influence upon the mentality of the subject, if for no other reason.

3. Operation should seldom be performed under the age of 8 to 12 years, unless the accompanying hernia demands such operative intervention, for the reason that in a considerable number of cases the testis descends spontaneously on the approach of puberty, unless double.

Abdominal ectopia unless double had best be left untreated, inasmuch as operation is difficult and by no means free from risk.

4. As to methods of operation, the main principles of any operation likely to yield satisfactory results, must be: Free opening of the inguinal canal, which is secured by Bassini's incision; thorough freeing of the testis from any adhesions or peritoneal bands, even with the sacrifice of some of the veins, if necessary; bringing the testicle into the scrotum; suture of the canal without transplantation of the cord.

The present tendency in favor of giving up all forms of suturing the testis, either to the scrotum, the other testis or the thigh is, I believe, fully justified.

Inasmuch as very satisfactory results may be obtained without cutting away all the structures of the cord except the

vas and its vessels, I believe this more radical step very seldom indicated.

5. No case of double undescended testis should be allowed to reach the age of puberty.

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OPERATION FOR UNDESCENDED TESTICLE.*

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FROM a brief scrutiny of the literature it would seem that there is thought to be a small chance of help for non-descended testicle except by castration. Erichsen [1] says, "Any attempt to bring the testicle down into the scrotum would be ineffectual." He further adds, that if it is in some position in the canal where injury is likely to occur, it is preferable to remove it. Treves [2] says the undescended testis should be stitched to the bottom of the scrotum, and under certain circumstances should be removed. Pick [3] thinks one should consider the feasibility of transplanting the gland and fixing it in the scrotum. If this cannot be done he recommends its removal. Bryant,[4] after describing a fascinating method, adds, "The successful attainment of these steps is not easy, nor finally as satisfactory as might appear from the description." Stonham [5] describes an operation where he makes a long incision and transplants the testicle, suturing the tunica albuginea to the scrotum. Kocher [6] recommends fastening the spermatic cord at its entrance into the scrotum, as well as fastening the testis to the bottom of the scrotum. Corner [7] says that replacement in the abdomen is indicated in by far the majority of cases. Bevan [8] describes an elaborate operation which necessitates opening the peritoneal cavity. Von Bramann [9] advises strongly against removal.

From the foregoing remarks it will readily be seen that there seems little to choose from in the various methods recommended. Some other writers advise massage and manipula-

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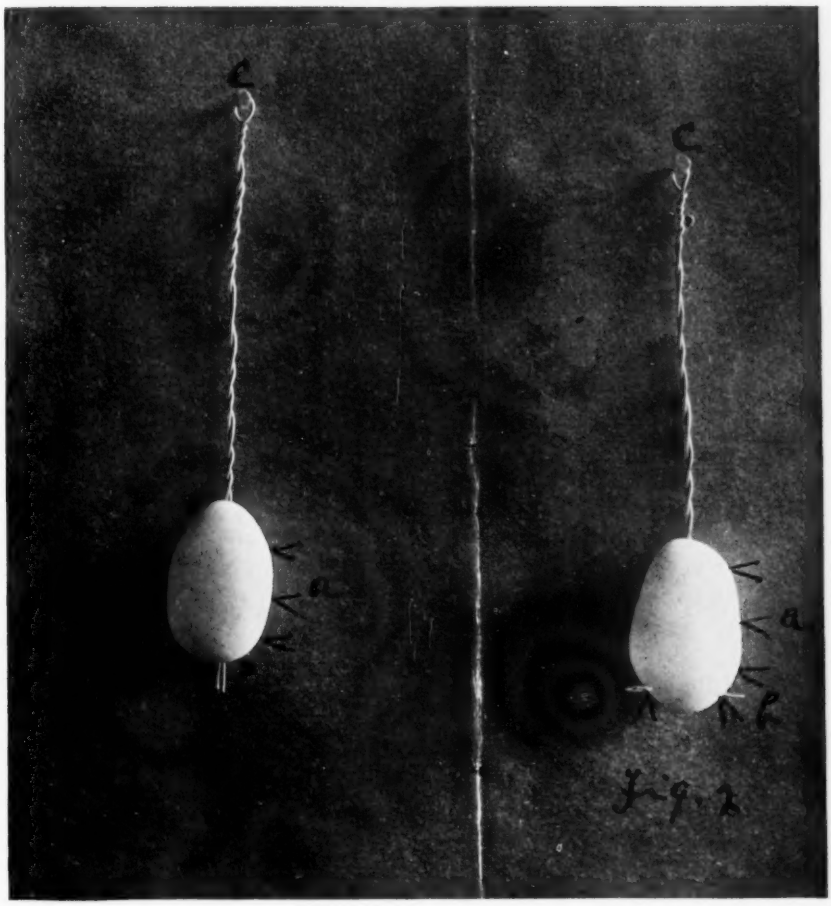
tion, and no doubt if begun early, and carried out persistently, some of the cases might be cured. Others have recommended a U-shaped truss to fit just above the testicle and force it down, while yet others have described various mechanical devices with the same object. Such methods have only to be mentioned to be condemned.

It would seem then that surgeons are divided between,—suturing to the bottom of the scrotum, transplanting within the abdomen, and removal. This latter cannot be too strongly condemned, for no matter how atrophic a testis may appear, one has no means of knowing the possibilities of development under suitable conditions.

When it comes to the question of operation, no doubt there are some cases in which, with the testis at or near the internal abdominal ring, it may be wise to transplant the gland within the abdomen, to remove it from the possibility of injury. But, when the testis is in the inguinal canal, near the external ring, or is outside the ring, the following operation which I have devised and carried out successfully, appeals to me as a reasonable means of securing a desirable result.

An incision about one inch long is made over the external abdominal ring, the testicle is secured and brought out of the wound. The finger is then carried down into the scrotum, and, by means of blunt dissection, the scrotal sac is stretched to make a suitable resting-place for the testis. The cord is then dissected free of its coverings, and if necessary to secure increased length, the cremasteric and spermatic arteries may be sacrificed, but the artery to the vas must not be interfered with. It is well now to see that the testicle can be easily replaced in the pocket provided without tension upon the cord. It is again taken out and sutured by means of chromic catgut, No. 0, through the tunica albuginea to the loops of a piece of plaited silver wire, two or three inches long, as may be required (Fig. 1 (a)). The wire ends at (b) are then pushed against the bottom of the scrotum and cut upon to permit of their being pushed through. The free ends are then bent, as in Fig. 2 (b). To make assurance doubly sure two horsehair sutures are

FIGS. 1 AND 2.



Showing testis secured to loop of silver wire to act as splint for retaining it in scrotum.

passed up through the tiny opening in the scrotum, from which the wire projects, one on each side of the wire shaft, to catch the tunica albuginea. They are brought out again and tied over the projecting wire ends (Fig. 3 (b)). The loop of the wire shaft at (c) is now sutured by means of 10-day chromic catgut No. 1 to the periosteum over the os pubis (Fig. 3 (c)). The testicle is now securely placed in the scrotum and is maintained there by means of a silver wire splint. The operation

FIG. 3.

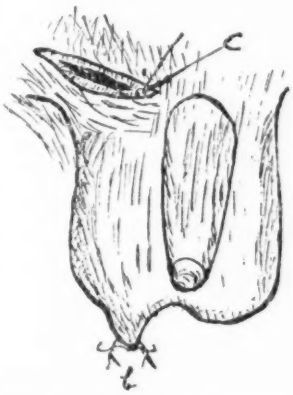


Diagram to show splint in position. (C) Catgut that secures loop of splint to periosteum over the os pubis.

is completed by introducing through the skin, at one end of the incision, a horsehair suture which travels sub-cutaneously, taking up the spermatic fascia and divided cremasteric muscle over the cord. It is brought out again through the skin, at the opposite end, carried over the top of a small roll of gauze, and continued along as an uninterrupted stitch, to bring the skin edges into apposition. The two free ends are tied over another small roll of gauze. The wound is carefully dressed with plenty of pads and a double spica applied. On the twelfth day the dressing is removed, and the cutaneous horsehair, snipped at one end, is then easily withdrawn. The two horsehair stitches at (b) are now cut and removed, when the end of the wire is grasped with a pair of forceps and the wire splint removed.

The result has been most satisfactory. Both testicles are on a level, both are now of equal size, though the non-descended one was small at the time of operation. There was no pain or discomfort during healing, and I was surprised at the ease with which the wire splint came away.

This operation holds out some hope for the correction of an abnormality that heretofore has not been amenable to treatment, other than such as will lead to a greater deformity, even though it does succeed in relieving pain and discomfort.

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THE RADICAL TREATMENT OF CARCINOMA OF THE BLADDER.

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THE percentage of ultimate cures effected by the various radical operations for carcinoma of the urinary bladder is very small and does not bear favorable comparison with that which is achieved in the radical treatment of carcinoma of other organs. These bad results are partly owing to the complicated problems we are called upon to meet in dealing with malignant neoplasms of this viscus, and partly to the fact that we have neglected to fully appreciate certain facts in the pathology of this disease.

The radical operative cure of a malignant tumor, according to our present conception, demands a wide removal of the primarily diseased tissue and of the secondarily affected lymphatics and glands. When malignant deposits have extended beyond the immediate local glandular apparatus or have appeared in distant organs, the idea of a radical extirpation of the disease can no longer be entertained. It is surprising how these axiomatic principles for the radical cure of malignant tumors are constantly ignored in cases of malignant growths of the urinary bladder. Thus it has been, and still is, the common practice to entirely ignore the lymphatics and glands in the radical operation for cancer of this viscus, owing possibly to the idea that these structures are usually not affected. This supposition, however, is entirely erroneous. In the very early stages of the malignant growth, when the neoplasm is confined to the mucosa and is not ulcerated, the lymphatics and glands usually show no malignant changes, but as soon as the tumor invades and infiltrates the muscular coats of the bladder the spread to the lymphatics and glands

takes place, and no operation can be a radical one that does not include a wide removal of these latter structures. In 56 cases of infiltrating cancer of the bladder collected by Guyon, glandular enlargement was positively recorded in 15, and in the other 41 no mention was made as to whether the glands were or were not involved.

In a previous communication the writer called attention to the necessity of a wide removal of all infected sacral and iliac glands and described the technic for their extirpation. (ANNALS OF SURGERY, 1904, vol. 40, 382.)

Another consideration of vast importance has only recently been called to our attention by Dr. F. Mandlebaum in his admirable study of "New Growths of the Bladder," published in Surgery and Gynæcology, V, 315, 1907. In 1870, Klebs (Handb. d. Path. Anat.) announced his view that carcinomata of the bladder are always secondary to primary deposits in the prostate, rectum, or uterus, and that in women at least a primary tumor of the bladder cannot be cancerous. This opinion was combatted by the school of Necker and defended again by Motz and Monfort. The importance of this point is very evident. If Klebs is right, then in the male subject the removal of the prostate is essential to every radical operation for bladder cancer. Mandlebaum carefully studied this particular question. He found that the papillary and the flat or squamous-celled carcinomata do occur as primary tumors in the bladder, but that the fibro- or scirrhus-carcinomata, and the adenocarcinomata are very often, if not always, secondary to primary tumors of the prostate, uterus, or rectum. Thus he had in his collection of cases five of fibro- or scirrhus-carcinomata. In these patients a clinical diagnosis of primary malignant tumor of the bladder was made, because a careful physical examination of the prostate and rectum had failed to reveal any evidence of malignant trouble in these organs. Yet a close study of the extirpated tumors and a postmortem examination in two of the patients revealed the fact that in four of the cases the neoplasm was primary in the prostate and secondary in the bladder. He

made a similar observation in two cases of apparent primary adenocarcinoma. In these two patients a postmortem examination showed that the prostate was the primary focus of disease, though no evidence thereof was furnished by a careful physical examination during life.

If the conclusions reached by Dr. Mandlebaum are confirmed by further investigation, their bearing upon the surgical aspects of vesical carcinomata will be very great. They teach us first of all not to rely upon the evidence furnished by physical examination in forming our opinion as to the existence of a malignant tumor in the prostate. Secondly, they demonstrate the great importance of knowing the exact histological character of every malignant tumor of the bladder before proceeding to its radical removal; for of what use is it to extirpate a part or the whole of the bladder if thereby is removed only a secondary deposit, while the primary growth in the prostate, uterus, or rectum is left unmolested? If the adeno- and scirrhus-carcinomata are found to be always secondary tumors, then the radical operation for their cure must include a wide removal of the primarily diseased part. In the light of Dr. Mandlebaum's investigations, the writer does not doubt that many recurrences after radical operations for vesical cancer are due to the fact that an unrecognized primary focus of malignant disease in the prostate, uterus, or rectum was left behind at the time of the operation, and he is convinced that attention to the facts brought out by Dr. Mandlebaum will better our percentages of ultimate cures of this malady.

With these preliminary remarks on the pathology of vesical carcinomata and the bearing they have upon the extent of operative procedures undertaken for their radical cure, we come to consider how best to deal with the neoplasm; and here the operator must give his attention not only how to widely remove the tumor, but also how to restore or substitute for the function of a urinary reservoir which the bladder serves.

This latter fact complicates the problem very much and has been and still is the subject of much discussion. If the

reservoir function of the bladder could be entirely dispensed with or satisfactorily and safely replaced or substituted for in some manner, a vesical carcinoma could be dealt with much as is a carcinoma of the gall-bladder, namely, by complete excision of the affected organ; but thus far all our experience has not succeeded in demonstrating how to so safely replace or substitute for this urinary function of the bladder. The use of the rectum, vagina, or partly excluded loop of intestine, *e.g.*, the sigmoid flexure or small intestine, as a substitute for the bladder, has been mostly abandoned because of the danger entailed thereby of an infection from these viscera ascending the ureters to the kidneys, with consequent pyelonephritis and death. Similarly, the doing away altogether with a urinary reservoir by implanting the ureters onto the skin of the abdomen or loin, or by direct drainage of the kidney-pelvis through the loin (double nephrostomy) exposes the kidneys to the same dangers of infection, and places additional worry, annoyance, and discomfort upon the patient in the attention and care that must be expended upon the toilet of the urinary fistulæ.

Our ineffectual efforts to provide a satisfactory substitute for the reservoir function of the bladder or to safely and conveniently do away with it altogether make it very desirable in the radical operations for vesical cancer to preserve enough of the bladder to act as a urinary reservoir, provided this is consistent with the requirements of a radical extirpation of the disease. This desideratum at once brings up the following questions:

1. Is it possible to effect a lasting and permanent cure of a vesical carcinoma by a partial resection of its wall, or is it necessary in every case to completely excise the viscus?

2. In case partial resection is consistent with the requirements of a radical extirpation, how much bladder wall must be left in order to make a satisfactory urinary reservoir?

As regards the first of these questions,—viz., is it possible to effect a lasting cure of a carcinoma of the bladder by a partial resection of its wall, or is it necessary in every case

to completely excise the viscus?—Rafin, in his masterly monograph on Tumors of the Bladder, published in Compte rendu de l'association française d'urologie for 1905, gives the results of 96 partial cystectomies for carcinoma. These cases were collected from literature and by personal communication with those in charge of large hospital services. Of these 96 cases, 21 died from the operation, and 25 could not be subsequently traced. Of the remaining 50,

1 was well after 3 years.
1 was well after 3 years and 4 months.
1 was well after 4 years.
1 was well after 5 years.
1 was well after 6 years.
16 were well at periods ranging from 6 months to 2 years.

Twenty-one of the fifty then were living without recurrence at periods varying from six months to six years, and five had passed the three-year limit. In view of these reports there cannot be any doubt of the possibility of radical cure by partial resection of the bladder.

It is true that the immediate mortality of the operation in the cases reported by Rafin is very high—21+ per cent.—and that the number of permanent cures is very small; but the fact is clearly demonstrated that by partial cystectomy a radical cure can be effected, and it is only reasonable to assume that with improved technique the operative mortality will be less, and that with earlier recognition of the disease and attention to the pathological facts already mentioned, the number of permanent cures will be much increased.

Watson, however, from an extended study of the cases reported in literature, takes a different view from that just expressed. He holds that the chief causes for the high mortality attending operations for vesical carcinoma and for their frequent recurrence seem to be in the failure to operate soon enough and radically enough. To quote his emphasized statement: "The very large percentage of recurrence seems to point logically to the necessity of more radical measures in

benign as well as in cases of malignant tumors, if we are to hope for better results. The suggestion I have to make in this report is that total extirpation of the bladder and of the prostate, if it be involved in the pathological process, be done at the outset in all cases of carcinoma that have not extended beyond the above named structures and in which it is believed that there are no metastases; and that the same measure be applied in all cases of benign growths in which recurrence has taken place after a primary operation for their removal."

He goes on to say that ureteral implantation which contributes, as it seems, to the surgical failures, should be abandoned, and *lumbar nephrostomy,* with ligation of the ureters done instead, and at some time previous to the operation for the removal of the tumor, as it seems to offer a much safer and less objectionable way of disposing of the most difficult part of the latter operation.

It is important that we consider in detail these statements of Dr. Watson, which have for their foundation not his own acute clinical observation and personal experience, but merely the records of cases reported in the literature.

In this consideration it is necessary first of all to compare the immediate and late results after partial and complete cystectomy. Rafin collected 30 cases of total excision of the bladder for carcinoma. In 17 of these there was a fatal issue to the operation, *i.e.,* a mortality of 56.5 per cent. Five of the surviving cases could not be traced; in 3 death occurred from kidney complications, 4 months, 13 months, and 5½ years respectively, after operation; and 3 were well 7 months, 15 months, and 5 years respectively, after operation. These results compare most unfavorably with those obtained after partial cystectomy, for in the latter the immediate mortality was much lower—21 out of 96 cases, *i.e.,* 21+ per cent., and the ultimate results were better, inasmuch as 21 out of 50 cases were known to be well and free from recurrence at periods varying from six months to six years after operation.

Of the 17 immediate operative deaths after complete

cystectomy in the series collected by Rafin, 9 were from renal causes, and it is possible that some of these might have been averted by a preliminary lumbar nephrostomy, as suggested by Watson. The latter author is in favor of complete extirpation for two reasons: (1) the dangers of recurrence after partial cystectomy, and (2) the dangers of ascending infection to the kidneys resulting from ureteral implantation into the bowel or vagina or on to the skin of the loin or abdomen. In answer to these objections to partial cystectomies it is to be noted that the percentage of recurrence after total extirpation of the bladder is almost as high as in those who survive the partial extirpation. Of Watson's 25 collected cases of complete extirpation, 11 survived, and of these only 2 were alive and free from recurrence after three years; 1, three years, and 1, eight years, respectively; whereas, of Rafin's 96 cases of partial cystectomy, the 50 that survived and could be traced, included 5 that had safely passed the three-year limit without recurrence.

As regards this question of recurrence, it is the writer's opinion that the dangers thereof are not materially dependent upon whether a complete or partial cystectomy be done, provided, of course, that the disease is widely extirpated; but that they are dependent, as stated in a preceding portion of this paper, first, upon whether all the cancer-infected glands and lymphatics are simultaneously removed with the primary tumor; and, secondly, upon whether, when the primary neoplasm is in the prostate, uterus, or rectum, these affected parts are likewise removed, together with the vesical tumor.

In other words, the writer thinks that where the carcinoma is primary in the bladder and limited to one part thereof, a wide removal of the neoplasm (partial cystectomy), together with all the lymphatics and glands, will afford as sure a protection from recurrence as will a complete extirpation of the organ.

In reference to the proposal that a preliminary bilateral lumbar nephrostomy with ligation of the ureters should replace ureteral implantation into the intestine or vagina, or onto

the skin of the abdomen or loin, Watson urges that the time of operation would be thereby shortened; that liability to kidney infection would be much less; and that the procedure supplies immediate and sufficient drainage from the kidney and is the best means for giving prompt relief to renal retention.

These arguments can apply *prima facie* only to complete extirpation with ureteral implantation into the intestine, or vagina or onto the skin, as against complete extirpation with preliminary lumbar nephrostomy, and not as against partial cystectomy with ureteral *re*implantation into the bladder; for in the first place the danger of ascending kidney infection through a ureter that has been reimplanted into a remaining normal part of the bladder is not greater than that after a lumbar nephrostomy. In fact, it would seem, judging from the writer's experience with this latter procedure done for other causes—*i.e.*, persistent hæmaturia, stone, etc., that some infection of the kidney pelvis always results therefrom.

Watson furthermore estimates the mortality resulting from ureteral implantation into the intestine, vagina, or skin, as being much higher than that resulting from direct lumbar nephrostomy. Of this there is no question. But we must not confuse the dangers of ureteral implantation into an infected viscus with the dangers resulting from ureteral reimplantation into the bladder, as is the case when a partial cystectomy is done. According to Watson's own figures, the operation of nephrostomy done for any and all causes is 15 per cent. Surely if we are to accept this figure as pertinent to nephrostomy done as a preliminary procedure to a radical operation for bladder carcinoma, we must acknowledge that for a preliminary step the mortality is inordinately high, and we could scarcely be expected to enter heartily into any proposal that promises so large a percentage of deaths before we even commence a radical cure of the disease itself. As a matter of fact, however, the writer does not believe that a preliminary nephrostomy—when the kidneys are comparatively healthy—

has anything like so high a mortality as 15 per cent., and surely ureteral reimplantation into a healthy part of the bladder, done according to the modern improved technic, as will be later described, is not attended with anything like 15 per cent. of immediate operative deaths.

As to the comparative dangers of infection of the kidney after bilateral nephrostomy and ureteral reimplantation into a healthy bladder, there are no reliable figures or extended clinical experiences upon which we can at present base conclusions. There are instances of late infection of the kidney pelves after lumbar nephrostomy as well as after ureteral reimplantation into the bladder, and only continued trial of the two procedures will demonstrate in which of them the dangers of late kidney infection is the greater.

Watson further dwells on the advantages of lumbar nephrostomy in case the kidneys are already infected. In such cases the good effect of drainage of the kidney pelves cannot be questioned, but surely one cannot contemplate a radical operation for the bladder cancer under such conditions. In patients with this complication, radical operations have no place—only palliative procedures are to be considered in them.

Furthermore, there are serious objections to a general use of lumbar nephrostomy in operation for bladder tumors. The proper care of such urinary fistulæ is possible only by the highly intelligent and cleanly who can be taught the principles of asepsis, and by those who do not have to engage in hard manual toil. In all others the dangers of kidney infection are much greater, and the wearing of an apparatus such as is described by Watson is hardly consistent with the occupation of mechanics or laborers.

Taking into consideration then all the facts: first, that the freedom of recurrence after partial cystectomy is as great as that secured by complete extirpation; secondly, that the immediate operative mortality after partial cystectomy is not half as high as that after entire removal of the bladder; thirdly, that the objections raised by Watson to ureteral implantation into the intestine, vagina or skin do not maintain

to ureteral reimplantation into a remaining healthy portion of the bladder, the writer is forced to the conclusion that when we have to deal with growths limited to a third of the bladder, and especially when their site is on the fundus and lateral walls, *partial cystectomy with reimplantation of the ureter into the remaining portion of the bladder when the ureteral orifice is involved in the disease is by far the operation of choice.*

It must not be inferred, however, that total extirpation has no place in our consideration of the radical cure of this disease, for when the cancer is diffusely spread over the greater part of the bladder, thus forbidding us to save a sufficient portion thereof to form a reservoir for the urine, or when there is a bad cystitis that does not yield immediately to therapeutic measures and which necessarily increases materially the dangers of ascending ureteral infection after reimplantation of the ureters, then complete extirpation is advisable provided the patient is otherwise sound.

The preliminary operation of lumbar nephrostomy would certainly seem to be indicated when complete excision is done.

In reference to the second question that I have proposed in connection with partial cystectomy, viz., how much bladder wall must be left to form a satisfactory reservoir for the urine?—there are no reports in the literature bearing upon this point. The writer in one case removed slightly more than one-half of the bladder, and the remaining portion performed the function of a reservoir very well. The patient could hold his urine easily for three hours; he had to get up twice at night to urinate, and was very comfortable. In his three other cases about one-third of the bladder wall was removed. In two of these latter that survived the operation the remaining portion of the bladder functionated excellently as a reservoir, the patients being able to hold their urine almost as well as in their healthy state. In the light of these experiences the writer would say that one should be able to remove fully one-half of the bladder without materially interfering with the function of this organ, and that the removal of a third

of the viscus does not have any appreciable effect upon the function of the remaining portion.

A few words in reference to the technic of partial cystectomy as done by the writer and described by him in ANNALS OF SURGERY, 1904, vol. 40. A median incision is made above the symphysis or a lateral one at the outer margin of either rectus muscle, depending upon the location of the tumor in the bladder as previously determined by the cystoscope. This incision is deepened down to the peritoneum, which latter is then stripped back from the pelvis and from the bladder. If the tumor occupies the peritoneal surface of the bladder the affected part of this membrane will likewise have to be removed. The peritoneal cavity is therefore best opened in such cases at once and the intestines protected with warm pads. With the patient in Trendelenburg's position search is made for glandular enlargement along the course of the internal iliac artery and in the concavity of the sacrum. When such glands are present, they are carefully removed, together with the surrounding fat. Such glandular enlargement must be sought for up to the bifurcation of the common iliac artery and along the promontory of the sacrum. During this procedure there is sometimes considerable oozing from the rich venous plexuses in the pelvic cellular tissues, but this can always be controlled by pressure with gauze or sponges. The ureter corresponding to the affected side of the bladder is now located and dissected out down to its entrance into this viscus, and the pelvic space is carefully lined with iodoform gauze so as to prevent its infection during subsequent manipulations. The bladder is opened in healthy tissues to one side of or above the tumor, and the surface of the neoplasm at once cauterized with the actual cautery or pure carbolic acid. I deem it the better plan to remove the neoplasm after the bladder has been opened, working from the interior outward, rather than to excise the tumor mass from without inward, for with the limits of the neoplasm directly visible it is possible to make a wider resection into healthy tissue. If the neoplasm is found to involve the lower end of the ureter, this is divided

in healthy tissue and the proximal end temporarily closed with a seraphin to prevent leakage of urine over the field of operation. The stump of the ureter is then reimplanted into the *vertex* of the *bladder.*

This reimplantation into the vertex, as against reimplantation into the base of the bladder at the site previously occupied by the neoplasm, is important for the following reasons: In the first place, if the ureter is implanted into the bladder at the site from whence the neoplasm has been removed, it will be very difficult to effect an impervious junction, and furthermore, inasmuch as at this site there is likely to be some marginal necrosis, the liability of ascending infection from such necrosis along the ureter to the kidney is very much increased. The defect in the bladder caused by the removal of the neoplasm is now closed with two layers of sutures, one a catgut Connell suture passing through all the walls of the viscus, and the other an external mattress suture of fine silk going through only the muscular coats. I have found it sufficient to drain the bladder through the urethra, but if deemed necessary a suprapubic opening for drainage may be established. It is very essential to provide liberal gauze drainage of the cellular tissues in the pelvis, always, however, taking the precaution to place a strip of rubber tissue between the suture line in the bladder and the gauze. The bladder drainage is removed after six days and the patient is permitted to pass his urine spontaneously. Frequent washings of the bladder at this time will relieve the cystitis resulting from the operative manipulations.

Thus far the writer has had occasion to practice this operation four times. In two of the cases the growth in the bladder was secondary to extensive uterine carcinomata, one of the patients being a young woman with extensive vaginal, uterine and broad ligament carcinoma, in whom radical operation was undertaken only because of the extreme youth of the patient and at the earnest solicitation of her friends and relatives. In one of these patients there was a recurrence of the malady in the pelvis a year and a half after operation, and in

the other evidences of returning carcinoma appeared after six months. Neither case was a favorable one for radical cure. As regards the bladder complication, although one-third of this organ had been removed and the ureter reimplanted into the bladder, the patient was able to hold the urine almost as well as in her normal state.

In a third patient the bladder cancer appeared to be favorable for operation. There was noted in the prostate before operation a nodule about the size of a small hazelnut which was not, however, thought to be malignant. The neoplasm in the bladder about the size of a silver half dollar and of a squamous-celled type, together with the terminal half inch of the left ureter was removed, according to the method described above, and the ureter was reimplanted into the vertex of the bladder. An uninterrupted convalescence took place. The wounds were completely closed at the end of four weeks, the patient had perfectly normal bladder function, and remained well for fourteen months after the operation. He then showed evidences of prostatic enlargement, and on examination it was found that the previously described nodule in the organ had increased very considerably in size and was hard and fixed. The removal of this nodule was deemed inadvisable and the patient succumbed to a prostatic cancer somewhat more than a year later, a little over two years after the operation. In this case the bladder tumor was probably secondary to the prostate cancer, and the prostate should have been removed together with the bladder tumor.

The fourth patient was a favorable one for radical operation. He had a tumor about the size of a silver half dollar occupying the right side of the bladder and the right ureteral orifice, was in good physical condition, and about 58 years of age. The lymphatic glands and bladder tumor were removed in the usual manner, but I deviated from my usual practice of reimplanting the ureter into the vertex of the bladder and followed the suggestion made by a colleague of making the ureteral implantation into the base of the bladder at the site occupied by the neoplasm. All went well until the sixth

day, when there were evidences of septic infection, a pneumonia developed at the base of the lung, and the patient succumbed three days later. At the autopsy it was found that there had been a leakage of a few drops of urine at the site of the ureteral junction and that there had been an ascending infection of the pelvis of the right kidney, which contained a few drops of pus. Whether this last mentioned condition or the pneumonia was the cause of death it is, of course, difficult to say, but the fallacy of reimplanting the ureter into the base of the bladder was well demonstrated, and in subsequent cases I should certainly not select this site for reimplantation. Unfortunately the writer was not aware that Albarran and Rafin have had the same experience with reimplantation of the ureter at the base of the bladder. They likewise have come to the conclusion that in partial cystectomy involving the ureteral orifice it is far more advisable to reimplant the ureter into the vertex than into the base of the bladder.

Simple removal of a cancerous tumor from the bladder, either by the curette or knife or actual cautery through a suprapubic opening without partial or complete cystectomy, has not been considered in this paper amongst the radical operations for this disease, although there are cases in the literature of a permanent cure having been accomplished in this way. Such instances are very rare and a lasting cure by an operation of this kind is possible only when the tumor is a pedunculated one and its base not infiltrated with malignant disease.

DISTURBANCES DUE TO DISEASE OF THE VERUMONTANUM AND ITS TREATMENT WITH THE POSTERIOR URETHROSCOPE.*

BY GEORGE KNOWLES SWINBURNE, M.D.,

OF NEW YORK.

WORK upon the posterior urethra through the urethroscope during the past eight or nine years has convinced me that it is a valuable aid and a distinct advance in the treatment of trouble in that portion of the genito-urinary tract, and that many obscure symptoms may be found to be due to disease or to some pathological condition of the verumontanum, or of the urethral floor in its immediate vicinity.

The most common cause of trouble in this part is, of course, chronic gonorrhœa, though I have had a large number of non-venereal cases in which trouble with the verumontanum seemed to be the disturbing element. The association, further, in many of these cases of an oxaluria has made me believe that this might be a factor in the pathogenesis of both these classes of cases. At the same time, while in some cases of oxaluria attention to the digestive tract has been sufficient to clear up the symptoms, in others the symptoms have persisted until the posterior urethra has been treated through the urethroscope. The following case seems to me to be typical of this condition.

B. D., 19 years old, consulted me as recently as March 14, 1908. For three years he has been troubled by persistent and frequent nocturnal emissions, constipated habit, facial acne, clammy hands. Has been obliged to give up studies which he was pursuing at night, while working during the day, so that he feels he can make no advance, unless his condition can be relieved.

* Read before the American Association of Genito-Urinary Surgeons, May 1, 1908.

During this time has been almost constantly seeking relief of one physician after another. During the week preceding his coming to consult me, had had emissions every night. The urine was loaded with oxalate of lime crystals. Never had venereal disease. There was a slight mucoid discharge which can be squeezed out of the urethra; contains bacteria, but no gonococci. The prostate and vesicles reveal nothing to the examining finger. Examination of the posterior urethra showed the entire verumontanum to be much swollen, very hyperæmic, bleeding very easily on touch with the cotton swab, and also on relief of pressure as the mucous membrane comes up into the window of the instrument during its gradual withdrawal. The entire floor of this portion of the canal was freely swabbed with a 10 per cent. solution of silver nitrate, or what is practically the same thing, argentamine in full strength. Attention was also paid to the digestion with a view to eliminating the oxaluria. The patient received five such applications at weekly intervals. At the last examination on April 11th the verumontanum was perfectly normal as seen through the urethroscope, it was not hyperæmic, it did not bleed. The oxalate of lime crystals were not found after the first examination and during these four weeks he had had but one nocturnal emission.

I do not mean to say that this case is by any means cured, but a healthier condition of the posterior urethra, especially the verumontanum, has been brought about more quickly than by any means with which I am acquainted, and it so clearly illustrates one phase of this condition, that of the simplest, that I cite it here.

In my experience this has generally been the condition of the verumontanum which has been found in these non-venereal cases:—a swelling and a hyperæmia of the entire verumontanum and a marked tendency to bleed easily.

In the cases which have been dependent upon a chronic gonorrhœa there has been a great variety in the urethroscopic picture as well as in the symptoms. In many of the cases in addition to the hyperæmia and swelling which is almost always present with the tendency to bleed on slight touch, there is a real hypertrophy as if due to a round-cell infiltration, and there is irregularity in the shape of the verumontanum and

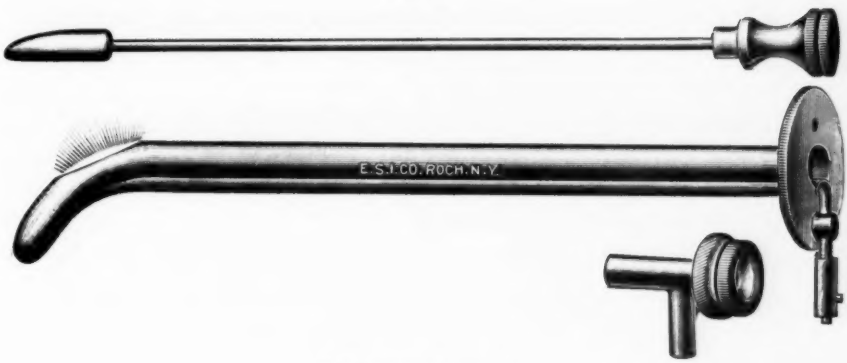
variations in the appearance of the surface of the mucous membrane, in some cases dull and dry and deeply reddened, or the surface is granulating, or there is a small granulation patch here, and there a small area looking like a bit of raw beef, and the general surface very irregular. There may be small excrescences looking like polypi springing from the surface of the verumontanum, there may be a small granulation tumor, a granuloma. This latter condition I have met with in two cases, and I can recall but two cases in which I have met with polypi.

The symptoms vary; there may be a simple mucoid or mucopurulent drop in the morning, or this condition may be constant without other symptoms. The urethra, on the other hand, may be perfectly dry. There may be a neurasthenic condition of any varying degree, and it may in some cases be accompanied by frequent nocturnal emissions and even diurnal. The seminal secretion may be blood-stained. There is in some cases—and this, I think, I have found in the majority of the cases—premature ejaculation or there may be complete impotence. Some of the cases complain of pain; this may vary from a slight feeling of discomfort along the urethral canal, or a tickling or a burning sensation, to a sharp lancinating pain. This pain or discomfort may, in some cases, be referred to the navicular fossa, or to the perineum, or to the deep urethra in front of the rectum, or over the pubes, sometimes over the sacrum. It may not be of great severity. In some cases there may be pain in the deep urethra, as if a foreign body were present. These pains are generally independent of the act of urination, or the pain may come only at the end of urination. Neuralgia of the testicle or in the sciatic region I have met with.

I have not attempted to give a complete account of all the symptoms which seem to be due to disease of the verumontanum, but only the most prominent and characteristic. I have presented this paper with a view to exhibiting to this society my instrument, already no doubt well known to you, to give

the reasons why I believe it to be the most practical working instrument to-day for dealing with the posterior urethra, finding, the more I have worked with it, the more satisfactory it has become. It was after considerable experience with the straight tube in the posterior urethra with the cold lamp, that I felt that a curved tube would prove more comfortable to insert, and it was in November, 1900, that I first ordered an instrument so constructed. The first sent me had the light in the beak, as in the aëro-cystoscope; I then saw that the light must be in front of the window for proper illumination, as the floor of the urethra filled the window and the mucous membrane was illuminated by transillumination. In January, 1901, I obtained the first practical instrument, the beak was left hollow, however, and my experience with one case, which is related below, led me to have this remedied. The first method to remedy this, was to fill the beak with cement, which was not satisfactory; afterwards it was filled with metal, as in the present instrument (Fig. 1). Three sizes were made: 24, 26 and 28 F., but of late years I find I use the size 24 almost to the exclusion of all others. An objection made to the instrument has been that one could not see lesions on the roof of the posterior canal. In working with the straight tube, I never saw any lesions in the roof. Most of the lesions are about the verumontanum. I have also come to prefer an instrument in which the Koch auxiliary chamber keeps the lamp out of the way, when treating the mucous membrane. I have had instruments made, in which the lamp was in the tube itself, for use either with the Chetwood lamp or the Otis light, but the Chetwood lamp interfered with swabbing, and the Otis light in my hands does not give as good illumination, nor is it so convenient in treating cases. In one instrument there was an attachment with window, so that air dilatation could be used in the posterior urethra, but I have not found that the surface is any better illuminated; lesions cannot be treated without removing the apparatus; and then, too, any moisture in the canal is blown through the chamber carrying the light, which interferes with

FIG 1.



Posterior urethroscope.

vision and might be productive of danger to the eye of the operator. Though this could be obviated, I have not attempted to do so.

In inserting the instrument, the patient lies on the table, hips slightly raised, the lamp is tested before being placed in the instrument, then the cord is detached. While inserting it I stand on the patient's right and insert the instrument as in passing a sound. When the beak reaches the cut-off, I change the instrument from the right to the left hand, pressing down above the pubes with the right hand, while with the left I gently push the instrument into the deep urethra until it has reached the point I wish, which should be so that the very posterior tip of the verumontanum with the portion of urethra posterior to it will come into the window. The cord is then attached, the broad shield is grasped between the finger and thumb of the right hand and held perfectly still, the wrist and palm of the hand resting on the symphysis, and then I gently withdraw the obturator. If the instrument has not been inserted far enough,—I can tell this by the appearance,—I often push the instrument deeper while looking through it at the window, without reinserting the obturator. If the instrument has passed too deep, and there is urine in the bladder, it will come into the tube. If there are only one or two drops, it can be removed with the cotton swab; if more comes, I withdraw the instrument and reinsert it.

Almost the only treatment which I have applied to the posterior urethra has been a 10 per cent. solution of silver nitrate or argentamine in full strength. In the March number of the *Zeitschrift f. Urologie*, 1908, p. 219, I have noted that Wossidlo, of Berlin, in an article on this subject, has used 20 per cent. silver nitrate and in some severe cases has used the electrocautery, applying it directly to the diseased portion. In this article Wossidlo presents an instrument very similar to mine, but the lamp is in the same chamber, and for that reason I do not think it as practical; furthermore, the manner of inserting the light renders the calibre through which the applications are made, smaller than the calibre of the tube. I

should think, however, that for granuloma or polypi the electrocautery would prove an excellent aid.

The manipulations, of course, are done under aseptic precautions. There is no after-pain in making application with this strong solution of silver nitrate and, as a rule, no discomfort except for the burning sensation at the next two or three times of urination, even though the cotton swab is soaked with the solution and freely applied, whereas I think, all will acknowledge the extreme discomfort of silver nitrate in much weaker solution, when applied through the instillator, an instrument I but very seldom use now. Furthermore, the latter is applied in the dark and does not reach the whole of the portion intended. Then, too, I have treated and cured many cases with the urethroscope that had had the instillation method applied for months by other operators.

I never use the urethroscope while gonococci can be demonstrated to exist, and seldom use it for treatment until all other pathological conditions, as trouble in the anterior urethra or prostatitis and seminal vesiculitis, have been removed so far as possible. These lesions are always treated until they seem incapable of further improvement; then, if the case seems to need it, I employ the urethroscope. I have sometimes had cases in which the gonococcus for a long time could not be demonstrated; one case I remember, in which marriage had been sanctioned by two competent men, in which after one or two or more applications through the urethroscope, a urethral discharge started up containing gonococci, and that, too, without further exposure to infection. When this has happened, and it has happened often enough for me to be on the lookout for it, I refrain from further use of the urethroscope until the trouble subsides. I have noted in some cases, having as a symptom frequent nocturnal emissions with an accompanying vesiculitis and prostatitis, that, while at first massage and treatment directed to these parts helped that symptom, it would return again, even while the treatment was carried on. In my experience these cases need treatment with the urethroscope.

The treatment is carried on by making the application once a week only—seldom have I ever made the intervals shorter, though in a few cases I have made them at intervals of five days. The average number of treatments has varied from three to twelve, sometimes more, but in such cases the intervals have been lengthened to once in two weeks and even longer as the condition has improved.

The following cases present interesting points:

CASE I.—H. B., 26 years old, was treated for an acute gonorrhœa in the spring of 1899,—it was his second attack. His first attack had occurred six years before and he had always after that suffered from its results. The present attack followed the only exposure since the first attack. Following his first attack he had had a double epididymitis, which occurred nine months after its beginning. After that he had had an internal urethrotomy performed, after this he suffered a good deal from neuralgia of frequent recurrence in the left testicle, had been treated for prostatitis and seminal vesiculitis by massage, without benefit to the condition of neuralgia. When he came to me, he had had these attacks of neuralgia for four years. He presented a mild degree of neurasthenia, and strongly objected to any urethral instrumentation, as he had had so much of it without benefit and had suffered much pain in consequence. Nevertheless, after his gonorrhœa had subsided, I persuaded him to consent to a urethroscopic examination of the posterior urethra. The verumontanum was much enlarged and the anterior half presented a granulating patch which I swabbed freely with a 10 per cent. solution of silver nitrate, and thereafter made five or six similar applications a week apart. He never had a return of the neuralgia after the first application, and at the last application the urethra presented a normal aspect.

The difficulties met with in this case especially brought me to consider the instrument which I had made.

CASE II.—A. M., 29 years old, came to the dispensary in the latter part of 1900, having a chronic gonorrhœa. Had recently come out of the hospital, where he had been laid up with double epididymitis. He had lost flesh and strength, his urine was very cloudy, his prostate was very much enlarged and he was still under treatment for his epididymitis. He suffered from consider-

able pain in the deep part of the canal, and in January, 1901, I examined him with the posterior urethroscope, he being one of the first cases on which I had used it. The passage of the instrument caused much pain, on withdrawal of the obturator the verumontanum came into the window. It was much hypertrophied, the surface was granulating, and in its middle portion appeared a small tumor like a granuloma. The surface was thoroughly swabbed, but on withdrawing the instrument, the tumor was found to have been curetted off and was in the beak of the instrument. It was followed by only a slight amount of bleeding, and several applications were made after this, and the patient was greatly improved and disappeared. Subsequently, five years later, he presented himself at my office, having an oxaluria, and, in conjunction with treatment for that condition, I had occasion to treat the posterior urethra for a congested condition making about four or five applications. Outside of this condition the canal was normal, and it was interesting to see it so many years after a considerable pathological condition had existed.

It was the accident occurring in this case which fortunately was a beneficent one, which led me to have the beak of the instrument filled to prevent a similar subsequent occurrence.

In many of these cases which I have thus treated, I have had occasion to re-examine the urethra after a longer or shorter interval following a course of treatment, and have been struck by the normal appearance of the verumontanum.

When I began urethroscopy of the posterior urethra, I feared the possibility of one accident, hemorrhage into the bladder from a profuse bleeding from this surface, but as time went by and no such accident occurred in any of the very great number which I have treated—I have the records of over a hundred cases during that time in my office practice and certainly many more in my dispensary work—I began to think this danger a slight one. Nevertheless, it did occur in the practice of one of my assistants last year. One Sunday morning, about eight o'clock, he telephoned me he was sending up a patient he wished me to see. The man came to my office suffering extreme pain. He had a constant tenesmus, made constant efforts at urination, and only a few drops of blood

passed. The distended bladder could be felt above the symphysis, a hard mass the size of a cricket ball; pressure over this tumor increased the pain immensely. Before sending him into a hospital, I thought I would see what could be done to relieve him. I passed a silk-woven catheter into the bladder, drawing off only a little blood, and then washed out the bladder as gently as possible with a warm solution of alphozone (quite hot), following this with a weak solution of peroxide, and then finished with a weak solution of adrenalin. Although the bleeding was not entirely stopped, he was much more comfortable, after I had succeeded in removing all the clots and while doing this elicited his history. For some time previous he had had massage of his prostate and then was subjected to a course of treatment with the urethroscope, having been treated with it about seven times in all, the last one being on the previous afternoon, when he was told that there was no more need of treatment. No bleeding had followed this last treatment, and at ten o'clock that evening he had passed a perfectly clear urine; but at one o'clock in the morning, while at work (he was a baker), he had occasion to urinate, when he was much frightened to find he was passing what appeared to be pure blood. This was quickly followed by the sensation of a full bladder and constant efforts to urinate with the passing of blood, until he was sent to me that morning.

I gave him urotropin and sent him home to bed, and visited him that evening; he had, during the day, passed rather frequently blood-tinged urine, but no blood or clots; he was very sore. The urine continued blood-tinged for forty-eight hours, then passed away. Two weeks later I made a cystoscopic examination of the bladder and found it normal.

FIBRINOUS CALCULI IN THE KIDNEY.

BY HOMER GAGE, M.D., and HOWARD W. BEAL, M.D.,

OF WORCESTER, MASS.

In considering urinary calculi, we are accustomed to think of the difference in consistence between the hard uric acid and oxalate of lime calculi, and the softer stones composed of the alkaline phosphates; the former so hard as to offer great resistance to the lithotrite, the latter crumbling easily.

But we are apt to forget that there are other bodies even softer, whose definite form and infiltration with crystalline deposits, bring them within the general classification of urinary calculi. They are sometimes spoken of as "blood calculi," "fibrinous concretions" or "colloid stones,"—are not very common, and the number of reported cases is very small. Their variety, and their bearing upon the theories in regard to the formation of urinary calculi, would seem to make them of enough interest and importance to warrant a brief description of such a case which came under our observation in 1906.

Miss A. C., 56 years old, was referred to the Memorial Hospital May 20, 1906, by Dr. P. T. O'Brien, of Clinton, Mass. Her father died of typhoid fever, her mother of "heart disease"—there is a history of tuberculosis on the father's side, but none in the immediate family; five sisters and one brother are dead; one after a long illness, at 24 years, nature not known,—the others, all from acute infectious diseases. The sister who is living, has been "troubled with gravel and has passed hard stones," but is now in excellent health, 60 years old.

She had pneumonia at seven, was sick two or three months, and has ever since been subject to coughs; has occasionally had a bloody expectoration. Had typhoid at 17, and jaundice at 19.

For several years was troubled with indigestion, pain in epigastrium and nausea, and in 1902, was jaundiced again. On September 6, 1902, at Memorial Hospital, she was found to have

an enlarged gall-bladder easily seen and felt, with the liver extending three inches below the level of the ribs; a gall-stone was found obstructing the cystic duct, and was successfully removed. Menstruation had ceased when she was 50 years old.

From the time she was 15 years old, until she was 30, she passed gravel in the urine—a gray-colored sand, that settled in bottom of chamber, would not wash out, and often had to be scraped out; none of this between 30 and 35, but in February, 1885, while dressing, was taken with severe pain in right side of back, with urgent desire to urinate. The urine was dark blood color, with small clots. During the morning, urinated every 15 to 30 minutes and the dark color of the first urine gradually changed to a bright blood color. Three days later the blood and increased frequency had disappeared, and the urine had become normal.

Two months later, after walking up a hill, had a second attack of pain, similar in character, but much less severe than the first, lasting but a few days; blood showed in urine twice on first day of attack. The next winter, 1885-1886, for two or three months, had several attacks of pain along line of right ureter; these occurred in day or night, often with several weeks between, lasting several hours, and disappearing gradually.

These attacks were always accompanied by smoke-colored urine, in which was a sediment of "a black, smoky dust." During the period in which these attacks occurred, she was unable to start quickly, reach far above her head, or go up a hill without inducing pain in her right side. Once in reaching for a picture, hanging on the wall, she was taken immediately with a pain which began one of these attacks.

From that time until 1904, she felt pretty well, did considerable work about the house, and had little or no trouble with her side. In 1902, at the time of her cholecystotomy, examination of the urine showed that it had a specific gravity of 1017, was acid, contained a very faint trace of albumin, no sugar, and in the sediment a few leucocytes and a few red blood corpuscles. On the day following the operation, there were also numerous epithelial and granular casts.

Present Illness.—Two years ago, while riding in an electric car, felt annoying pain in right back, extending down right side toward bladder. Urinated once an hour, urine contained no

blood, but was thick and ropy. Similar attacks, beginning with severe, sudden pain, and lasting five or six days, recurred at irregular intervals, until present.

These attacks confined her to bed, and were accompanied by chills, fever and vomiting. For several months the attacks were infrequent, but toward spring increased in frequency, lasted longer, and were more severe. In August, 1905, she passed four small stones and from then until the time of the operation, thinks she passed between 30 and 40; some as large as a good-sized bean.

Miss C. was very thin, skin had a yellowish color, tongue was coated, breath sounds were harsh on the left side anteriorly, heart was normal. There was marked tenderness on the right side of the abdomen, but the right kidney was but indistinctly felt, tender, but not enlarged. Pulse, 68, temperature, 98.5°; respiration, 20.

The urine, on entrance, had a specific gravity of 1020, was alkaline, had a faint trace of albumin, no sugar. In the sediment were no casts, and no blood, many bacteria, mucus, few leucocytes, epithelial cells, amorphous phosphates and dicalcic phosphatic cystals.

A cystoscopic examination of the bladder was made on the 26th of May, by Dr. H. W. Beal, with the following results:

Nothing abnormal noted in appearance of bladder. Twenty-seven c.c. of urine were withdrawn by catheterization of the ureters from each kidney; that withdrawn from the right kidney was yellow, alkaline, sp. gr. 1010; it contained a distinct trace of albumin, no casts, numerous amorphous urates, no tubercle bacilli, but many uric acid crystals, epithelial cells, bacteria and pus-cells, with a few red blood corpuscles. From the left kidney, amber, acid, sp. gr. 1026, with marked trace of albumin, uric acid crystals, epithelial cells, and red blood corpuscles.

In spite of the presence of red blood corpuscles and epithelial cells in the urine of the left kidney, inasmuch as the amount of urine and its specific gravity were satisfactory, it was determined to cut down upon the right kidney, which had been the constant seat of the pain, and from the presence of the pus-cells and bacteria, was evidently the seat of a marked pyelitis.

Accordingly, on June 1, 1906 the kidney was exposed through a six inch lumbar incision; its external appearance was normal but the pelvis and upper end of ureter were markedly

dilated; a small incision revealed the presence of numerous calculi in pelvis of kidney, extending well down into the ureter. The kidney was removed entire, and the end of the ureter was sutured to the skin.

The operation was done under gas-ether, and occupied 35 minutes; her convalescence was delayed by a severe bronchitis, and some superficial suppuration, so that she did not leave the hospital until July 3, 1906, five weeks after the operation.

Examination of the urine, made after the operation, showed always a distinct trace of albumin, a specific gravity ranging from 1010 to 1024 a few hyaline casts on the second day, none afterwards, and always many leucocytes. Four weeks after the operation, she was passing 13.68 Gm. of urea in 24 hours.

She was re-admitted to the hospital August 27, 1906, with a sinus six inches deep in the line of incision; this sinus was enlarged, curetted and packed with iodoform gauze; it was entirely healed, and she returned home on September 17th. At this time, her urine still contained a large trace of albumin, and many leucocytes. A catheterized specimen was not obtained.

Subsequent History.—At the present time, Miss C. reports that her general health has been very much better since the operation; that she has weighed more than for five or six years past, and that she has been able to work. She looks well, and physical examination reveals nothing abnormal. She passes about 24 oz. of urine in the 24 hours, and has no increased frequency, and no pain.

Examination of urine, obtained per catheter, showed normal color, acid reaction—specific gravity, 1014. Albumin, by nitric acid absent; by heat test, a slight trace. Sediment, obtained by centrifuge, showed an occasional leucocyte, and very few bacteria —amount of urea was 1 per cent.

We think it may be safely inferred, that the remaining kidney presents none of the pathological conditions which characterized the one which was removed. Examination of the kidney after its removal showed that the capsule was not adherent and the renal substance was but little thickened; the pelvis of the kidney was tensely distended and completely filled with clay-colored bodies which turned brown after exposure to the air, were of the consistency of moderately hard putty, and varied in size from a large bean to the head of a pin.

There were 10 or 12 large ones, and a great many smaller ones, more than 100 in all; all, even the smallest, presented smooth, faceted surfaces, like those of gall-stones. Their general appearance, as they lay in the pelvis, and extended down into the ureter, is admirably shown in the accompanying drawing.

The specimen was subsequently sent to Dr. F. B. Mallory, whose report is as follows:

"Specimen consists of kidney, incised through the hilus, and preserved in alcohol. The kidney is a little enlarged, and the pelvis and beginning of the ureter are considerably distended. The latter contained in the fresh state many soft, more or less rounded, reddish-gray masses, some of which are still attached to the calices of the kidney; the others are free in the alcohol. (Figs. 1 and 2.)

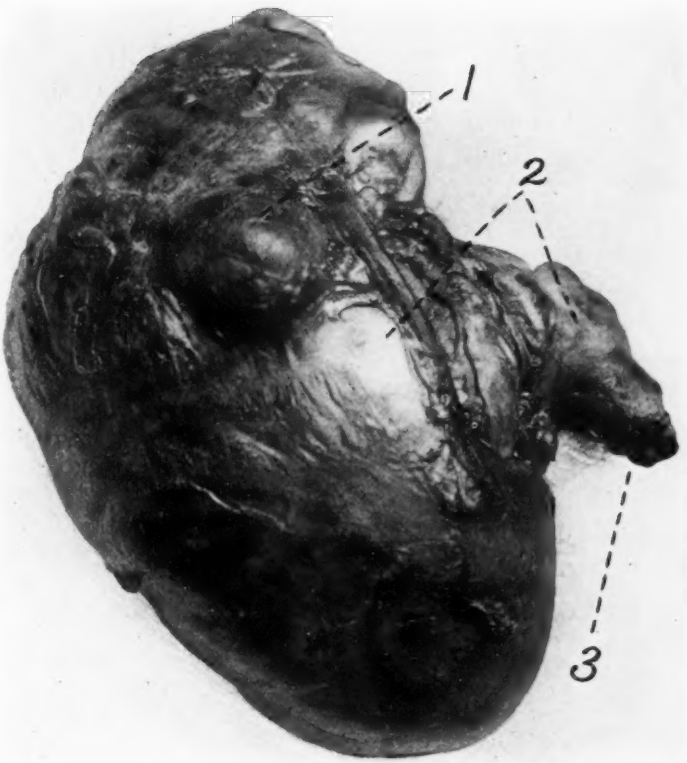
"They vary very much in size; the largest received measures 1.8 x 1.3 x 0.9 cm. They are irregular in shape from pressure against each other, are easily broken up, and seem to be composed of thin layers. Microscopically, after decalcification the material seems fairly homogeneous; but it shows a concentrically laminated arrangement, and in places there is a meshwork, evidently composed of fibrin threads, out of which each calculus is probably formed."

Some of the calculi were sent to Dr. R. L. Emerson, to determine the nature of the infiltrating salts, who reports: "The renal calculi which I received from you July 16th, are composed chiefly of calcium phosphate. There was mixed with the calcium phosphate, more or less altered blood which tended to cover the stones at various times during their formation and accounts for their more or less concentric appearance. I could get no test for uric acid, triple phosphate, or calcium oxalate."

These calculi consist, therefore, of alternating layers, concentrically arranged, of calcium phosphate and fibrin, and may be properly classified as fibrinous calculi.

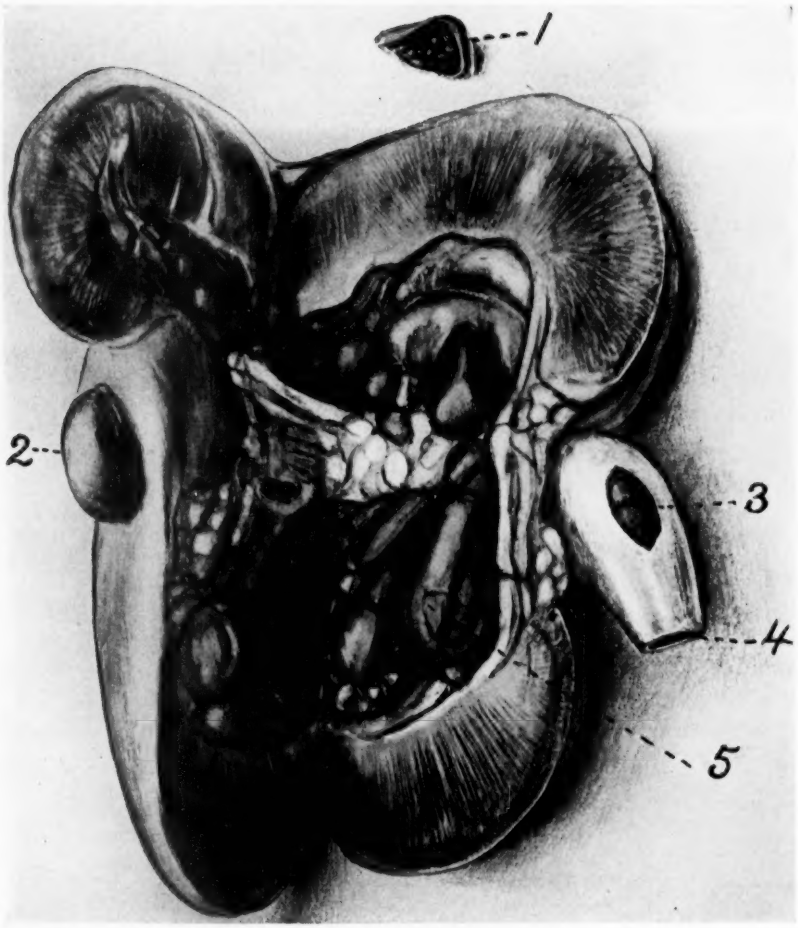
The first mention that we have been able to find of fibrinous calculi, occurs in Marcet's "Calculous Disorders" (1817), in which he says of a calculus sent to him by Sir Astley Cooper, that "It was neither cystic nor uric, but that it appeared to consist of hardened animal matter, probably of the albuminous kind; that upon closer examination its properties correspond exactly to those of fibrin, and therefore if the occurrence of similar concretions should render it necessary to give them a name, they might, I think, without impropriety, be called fibrinous concretions." The patient from whom this

FIG. 1.



1. Surface cyst. 2. Pelvis and upper end of ureter distended with calculi. 3. Cut ureter.

FIG. 2.



1. Section of calculus. 2. Surface cyst. 3. Window showing pelvic portion of ureter crowded with calculi. 4. Cut ureter. 5. Pelvis of kidney, dilated and crowded with calculi.

specimen was obtained, had already passed three calculi of similar character, and all nearly the same size, viz., "Size of a pea."

In 1837, Dr. Hodgkin described two calculi taken from the bladder of a boy, aged two years; and the description is so like the calculi found in our case, that it seems worth repeating.

"Instead of presenting the hardness and resistance of solid bodies composed of earthy matter, they possess, on the surface at least, a degree of softness and elasticity, as if covered with a fleshy layer. The material of which the surface was composed, exhibited a slight degree of translucence, not unlike that of some blighted acephalocyst membranes. These unusual characters induced at first some doubt respecting the nature of these bodies.

"Section made through one of them, showed that they in part consisted of an opaque white substance, having an earthy texture arranged in concentric but fragile layers. Two or three thin layers, consisting of a material precisely similar to that of which the external coating of the calculi was composed, were situated between the layers possessing the earthy character.

"Although the earthy layers were so brittle as to be crushed by the act of making the section, the fragments were so completely retained in their relative situations by the tenacity of the membranous layers, that the two portions into which the calculus was divided, were able to retain their form and cohesion."

Dr. Hodgkin believed that, "A nucleus existing in the bladder at the time became invested with coagulated fibrin, as a stick does when agitated in recently drawn blood; that when the character of the urine again changed the deposition of phosphates took place and inclosed the fibrinous layer."

The repetition of these occurrences appears sufficiently to account for the production of these calculi, and to be strictly analagous to the process by which other alternating calculi are formed.

Civiale refers to bladder masses which have to be exposed before they can be recognized as true semifluid calculi, in which the animal matter greatly exceeds the mineral matter; and further, of small gravel stones of soft consistency, combined with a large quantity of semiliquid substance.

His references are plainly to the thick mucus, which he says often dries outside the bladder in dirty gray scales, and can collect on the surface of a vesical calculus and there pro-

duce a real horny layer. He also mentions a fibrinous calculus, the size of a bean, yellow, and half transparent, which was extracted from the bladder of a cadaver by Sir Benjamin Brodie. It had the appearance of amber, lost much of its volume in drying, and its presence had not been suspected during life.

In 1857, J. Scott Alison, in examining the body of a man who had died of consumption, found "the left kidney to be greatly atrophied, changed in structure, and to have the infundibula and pelvis stuffed with hard bodies, most of which are of a coal black color. The largest of these is the size of a horse bean, looks somewhat worn and disintegrated, and at one point resembles a piece of decayed wood. At one side it is black from the pressure of altered blood. It is very light in weight, and is composed of blood and phosphate of lime."

To these he gave the name of blood calculi, and explained their formation by the presence of an "inflammatory action, set up perhaps by the pressure of small calculi of phosphate of lime. Blood was probably effused in consequence, and from suppression of urine, remained in the infundibula and pelvis, and failed to be washed down the ureter. This blood hardening, would form the calculi which were discovered."

Roberts, in his "Treatise on Urinary and Renal Disease," refers also to calculi of inspissated blood, and refers to a case in which several such concretions were found loose in the infundibula and pelvis of a kidney which had been ruptured by external violence. These seem to have contained little or no earthy matter, but he says, "Such concretions sometimes serve as nuclei for uric acid or oxalate of lime calculi."

Generisch, in 1903, showed "a colloid stone from the renal pelvis, found in a 39-year-old porter; granular contracted kidneys, and cardiac hypertrophy were present."

"The calculus is the size and shape of a castanea nut, tapering at one end, measuring 32 x 29 x 24 mm., weighing 13.9 Gm. The surface is smooth, with the exception of protuberences the size of a bean in two places. The color is grayish-brown, somewhat translucent. A needle can be inserted 4 mm. deep into the calculus, when it strikes a hard nucleus.

"On section, the calculus shows a hard nucleus, the size of a hemp-seed, formed of black calcium oxalate, surrounded by a softer light red layer of uric acid. The latter was followed by a firm layer of calcium oxalate, which in turn was surrounded by a yellowish mantle of urates."

The tetrahedral nucleus described above, "was covered with a colloid layer, in the form of scales and lamellæ, which could be scraped off with the finger-nail or cut with a knife." He goes on to say, "that the colloid covering of the calculus seems to give a hint as to the growth of calculi in general."

"The scales and lamellæ point to the conclusion that the organic formed substance of the calculus is deposited first, and the inorganic substance added later. On the other hand it is not impossible that a colloid layer might have been deposited in the renal pelvis, secondarily and independently of the calculus formation; as we are dealing with a case of contracted kidneys in which there is abundant formation of colloid substance."

In 1904, Dr. Elliott, of Boston, published an account of two fibrinous concretions successfully removed from the bladder of a man 54 years of age. "They were of a lightish-yellow color, with smooth surfaces, slightly wrinkled, and of the consistency of firm putty. The structure was homogeneous, slightly gritty, giving the impression of coagulated material, fibrin and mucus mixed with particles of urinary salts, in the centre of which was a small nucleus, composed chiefly of calcic phosphate."

In 1906, appeared an article by Dr. Piollet, on "Calculous Pyonephrosis with Abnormal Organic Concretions—Lumbar Nephrostomy—Recovery." The essential features of this most interesting case were the removal, by incision of the kidney, of half a litre of thick, yellow, fetid pus, about 50 dark soft concretions, and two round hard calculi.

These soft concretions varied in size from that of a grain of wheat to that of a large nut. They were elastic, like rubber; in shape, generally round, with facets flattened by reciprocal pressure. They proved to be almost entirely composed of organic matter in concentric layers, albuminoids and fibrin. The ashes were composed of phosphates, in very small quantities.

The similarity between the calculi described in these re-

ports, and those found in our own case, will be readily observed. In none were so many found, however, as in our patient; and in but one, was the smooth, facetted appearance noted, such as is commonly found in gall-stones. Most of them present a framework of fibrin, in which have been deposited crystals of phosphate of lime.

If we accept Rainey's theory of the formation of urinary calculi by molecular coalescence, a theory which has been further elaborated by the observations and experiments of Ord and Ebstein,—these differ from the more common calculi simply in having a large excess of the colloid or cement in which the inorganic salts of the urine are deposited,—from the great predominance of this cement, we are able easily to demonstrate that it is made up of fibrin, and not of mucus, pus, or other albuminoids.

The origin of this fibrin in our own case, as is believed usually to be true of fibrinous calculi, lies in a previous hæmaturia, which from the patient's history, occurred at several different times, and quite profusely a few years before she came under our observation.

The cause of the hæmaturia is not clearly established by the examination of the kidney, and we have no means of knowing whether the bacterial invasion of the renal pelvis preceded or followed the hemorrhage.

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HÆMATURIA AS A COMPLICATING FACTOR IN APPENDICITIS.

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THE following three cases illustrate the practical difficulties encountered as a result of the development of hæmaturia due to appendicitis.

CASE I.—P. F., 28 years old, a native of Russia, gave a negative family and past history. Present history dates back three months, during the course of which time he had two acute attacks of abdominal pain. These attacks had been diagnosed as appendicitis by a New York surgeon who had also advised operation. A week before admission to the Jewish Hospital of St. Louis he had a similar typical attack of acute appendicitis. When the patient entered the hospital all acute symptoms had subsided, and the physical examination was negative except for a slight residual tenderness over McBurney's point. The urine at this time was free from all pathological elements. Preparation for appendicectomy was ordered, but about eighteen hours before the time set for operation the patient suffered excruciating pain in the right lumbar region. His temperature rose a degree and a half, but his pulse-rate remained normal. There was only minimal pain over the appendix, but slight pressure in the lumbar region caused great pain. This lumbar pain remained localized, and did not radiate along the right ureter. An examination of the urine, made at this time, gave the following findings: sp. gr. 1015, color, dark brown, turbid; reaction, acid; albumen, trace; sugar, none; casts, none; blood, abundant (20 to 100 red cells to a field). On the basis that the attack might be due to renal colic rather than to appendicitis, we deferred operation. An X-ray picture was taken but it did not show the presence of a stone. A cystoscopic examination was negative. No tubercle bacilli were

found in the urine. This attack lasted two days, and after its subsidence the patient was observed for three weeks. During this period there were two attacks exactly similar to the first one. Exploratory laparotomy was now decided upon, with the idea of examining the appendix first, and if that organ were found to be normal to expose the right kidney. The operation disclosed a very acutely inflamed appendix. The patient was traced for six months after the appendicectomy, and during this time he was hard at work, manifesting no evidence of renal or intraperitoneal disease.

CASE II.—A. S., 28 years old, Russian, peddler, family and past history negative. Three days before admission to the hospital he had an acute attack of pain limited to the right iliac fossa and right loin, accompanied by fever (101°) and tenderness over the whole right side of the abdomen. There had been no chill, no vomiting, and no other symptoms referable to the gastro-intestinal tract. The disease had been diagnosed by Dr. Friedman as appendicitis. When I saw the patient his temperature was 100.6°, his pulse 99, and there was slight tenderness over McBurney's point. The abdominal walls were lax. In the right loin, tenderness was exquisitely marked, and at this site there was distinct bulging, over which deep fluctuation could be made out. At the time of this examination the urine was bright red in color, due to the admixture of a very large quantity of blood. An aspirating needle inserted into the bulging mass in the loin withdrew extremely foul-smelling pus. The result of the aspiration, the severe hæmaturia, the laxness of the abdominal walls, the minimal amount of abdominal tenderness, and the absence of marked gastro-intestinal symptoms, led me to make the diagnosis of perinephritic abscess due to primary renal disease. The patient was too septic at this time to attempt to determine the exact nature of the kidney lesion. The perinephritic abscess was opened and drained, and the patient returned to bed. He never rallied from the operation, dying eighteen hours later. A post-mortem examination disclosed a general diffuse purulent peritonitis, due to a totally gangrenous perforated appendix. The cæcum lay directly anterior to the right kidney, and the appendix was retrocæcal, lying upon the kidney. The entire perinephritic tissue, including the kidney capsule, was gangrenous, and the kidney was so intensely congested that it was a deep

blue-black in color. There were numerous infarctions of the kidney cortex.

CASE III.—I. T., 34 years old, seamstress by occupation. Family history negative. Ten years ago she had a profuse pulmonary hemorrhage and was told by her physician that she had tuberculosis. After a prolonged stay in a Northern resort she was pronounced cured. Present history dated back four months, the chief complaints being frequent painful urination, and continuous backache, with intercurrent acute attacks corresponding in every detail with the symptoms of renal colic. The patient stated that in one of these attacks three months ago she urinated pure blood, but that she never noticed blood in her urine before or after this. The day after her visit to the office she had an acute attack in which she experienced pain in the right loin, radiating down the right ureter. The pain was so severe that she fainted. Physical examination disclosed slight dulness over the apex of the right lung anteriorly, tenderness over the right kidney and along the course of the right ureter, and the presence of a faint trace of albumin and a few red blood-cells in the urine. There was an afternoon temperature of 99.5°. Tubercle bacilli were never discovered in the urine. Ureter catheterization was done by Dr. Johnson, with the following result: The bladder mucosa was normal, as was also the ureteral openings. A ureter catheter readily passed up the left ureter to the kidney. The right ureter was blocked at a point about two inches from the bladder wall. Even a stylet-armed catheter could not be forced by the obstruction.

These findings led to the thought that a ureter stone was causing the obstruction and all the other symptoms already detailed. Five X-ray plates made at three different sittings by Dr. Carman showed in each instance a clear-cut shadow in the course of the intrapelvic portion of the right ureter. Pain was persistent, excruciating, and incessant after the catheterization, and this symptom confirmed us in our belief that a stone had been dislodged from a fairly comfortable resting place.

At operation, the ureter was exposed by the iliac extraperitoneal route, from the kidney to the bladder, but no stone was found in it. At the site where the X-ray showed a shadow, the ureter was kinked as if pulled upward and inward. At the site of kinking there seemed to be a hard nodule resting on the

anterior surface of the ureter, and in order to determine exactly what this nodule was the peritoneum was opened. Through this opening we made out that an inflamed appendix containing a stony hard concretion was adherent to the anterior surface of the ureter. At the site of adhesion the ureter was pulled upward and kinked. Appendicectomy was done, the peritoneum sutured, and the wound in the soft parts closed around a drain. An X-ray picture was taken of the appendix immediately, and this picture gave a distinct shadow of the concretion. The appendix was then opened and found to contain a few drops of pus in its dilated tip, back of which there was a dense fecal concretion that had formed about a small seed with a hard chitinous capsule. (The seed was somewhat larger than the seed of a tomato.) The patient reported six months later that she was perfectly well.

Here then, are three cases, all of them encountered within a short period of time, and all of them characterized by the facts, first, that they were wrongly diagnosed by the operating surgeon, secondly, that pain radiating from the kidney region, and blood in the urine were prominent symptoms, and thirdly, that the lesion was in the appendix. By a strange coincidence this set of three cases establishes a basis for a rational classification of instances of hæmaturia complicating appendicitis. The first case was one in which no direct relationship could be established between the lesion in the appendix and the hæmaturia. Dieulafoy [3] asserts that there is an intimate relationship between acute appendicitis and nephritis, and he bases his assertion on the clinical observation that acute nephritis so often accompanies acute lesions of the appendix. The nephritis, which Dieulafoy calls " Nephrite toxique appendiculaire," is supposed to be due to irritation of the kidneys by the toxins resulting from the inflammation of the appendix. Dieulafoy states, furthermore, that the severity of the nephritis is in direct proportion to the acuity of the lesion in the appendix. Whether this last statement be true or not, it certainly is a fact, that acute appendicitis often causes an acute nephritis, and there is no reason for not believing that the inflammation of the kidney may result in the presence of red

blood-cells in the urine. Dieulafoy, in his paper, makes no mention of hæmaturia, but Hildebrand [4] in a paper confirming Dieulafoy's observations, records a case of acute appendicitis complicated by a well-marked hæmaturia. In this case, the hæmaturia disappeared after the acute inflammation of the appendix subsided, but reappeared with a second attack of appendicitis, finally disappearing for good, after the appendix was removed. Accepting, then, the views of Dieulafoy and Hildebrand, we may assume fairly that in our first case the hæmaturia was due to a toxic nephritis, secondary to appendicitis.

In our second case, the bleeding was due to a direct involvement of the kidney, as a result of the proximity of an acutely inflamed and gangrenous appendix, which had infected the perinephric fatty and cellular tissue.

In our third case we know that the ureter was kinked by an adherent appendix, but we cannot state positively just what caused the presence of blood in the urine. Possibly the kinking of the ureter caused a venous obstruction, and a consequent slight outpouring of blood from the ureteral mucous membrane. I can find in the literature only two other cases of appendicitis that caused marked urinary symptoms due to adhesion between the ureter and the appendix. These cases are reported by Lancien,[5] but he makes no mention of hæmaturia as a symptom.

Bearing our three cases in mind, we see how readily they lend themselves to the following classification: (1) Cases of hæmaturia due to the actions of toxins upon the kidneys; (2) cases of hæmaturia due to direct involvement of the kidney; and (3) cases of hæmaturia due to direct involvement of the ureter. If, in addition to the three cases reported in this paper, we examine the recorded cases in literature, we find one other source of hæmaturia complicating appendicitis. Cases are recorded in which the urinary bladder was perforated by an appendicular abscess, one of the symptoms of the perforation being blood in the urine. (Odde and Silhol,[6] Lancien,[5] Brun.[7])

A complete classification of the subject therefore would have to be framed as follows:

Hæmaturia complicating appendicitis may be due to:—

1. General systemic invasion resulting from acute appendicitis, and affecting the kidney indirectly,—so-called toxic nephritis.

2. Involvement directly of one or more of the organs of the urinary tract.

a. Kidney, as in case 2 of this paper.

b. Ureter, as in case 3 of this paper.

c. Bladder, as in the cases recorded by Odde and Silhol, Lancien, and Brun.

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The recorded cases of blood in the urine of patients suffering with appendicitis are very scanty. There are no papers in English, French or German, that take up the subject by title; but the following papers all have a direct bearing on the subject.

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NOTE.—Since the completion of this paper, an article has been written by Dr. Gray L. Hunner (Jour. Am. Med. Asso., Apr. 25, 1908) emphasizing the importance of hæmaturia as a complicating factor in appendicitis.

VOLKMANN'S ISCHEMIC PARALYSIS.*

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ISCHEMIC paralysis, first described by Volkmann in 1880–81, is a comparatively rare lesion if one is to judge by the small number of cases in the literature. However, as its importance has been emphasized in the last few years, a rapidly increasing number of cases has been reported. In 1904, Schramm could collect only 27 cases. In 1907, Powers collected 52 cases, to which I am able to add 6 cases from the recent literature and one personal case which will be described later. In the last four years more cases have been reported than in the preceding twenty-four years, which is rather an index of the increasing interest in the subject, than of the greater frequency of the lesion.

In all but two of the 59 cases the forearm was involved (flexor muscles). The other two cases occurred in the flexors of the leg and foot. The great majority of cases occur in children from three to twelve years old. Their vessels are less mature and the circulation of their muscles is more easily disturbed. The underlying cause in all these cases is ischemia (or, better, oxygen-deprivation), which may be induced by direct compression of the vessels and muscles, or by contusion, laceration, thrombosis, or embolism of the vessels. These factors may be more or less combined. At least 80 per cent. of the cases reported have followed fractures where splints or plaster bandages have been too firmly applied. The fractures have involved the arm and forearm in about equal numbers; always the lower third of the humerus in the arm, and usually the middle of the bones in the forearm. Complete ischemia,

* Read before the New York Surgical Society, April 8, 1908.

persisting for more than six hours, is almost sure to be followed by serious contracture.

Pathological Changes.—At the time of injury, the circulation distal to the fracture is interfered with by the mechanical displacement of the fragments, and the effusion of blood which is greater than is usually supposed (Hildebrand). The artery may be narrowed, torn across, or thrombotic. At a later time the artery may be entirely obliterated for a considerable distance, as in Peterson's case. Too tightly applied dressings not only enhance the obstruction to the arterial supply but add the element of direct pressure upon the muscle-substance itself. How important a factor this direct pressure may be, is indicated by the formation of areas of pressure-necrosis and abscess in the proximal portion of the flexor muscles and skin of the forearm, where the pressure is greatest, in 60 per cent. of Schramm's cases. Riedinger believes the direct mechanical pressure upon the muscles is the important factor more often than interference with the arterial supply, since, in his four cases the area of muscle damage was exactly coincident with the pressure-area. In either case, if the pressure continues for more than six hours, the muscle substance rapidly degenerates, enters a condition of rigor mortis, and shortens, causing the typical deformity. When the pressure is relieved, there is marked effusion from the damaged vessels, and round-celled infiltration of the soft tissues. The muscle is more or less replaced by connective tissue according to the severity of the case. With the lapse of time the cicatrix becomes harder, shorter and the deformity more fixed.

Primarily the nerves may show no change, or may show degeneration as a result of the ischemia and pressure. Later, whether primarily involved or not, they may suffer degeneration from the pressure of the contracting cicatrized muscles, and this in turn results in atrophic changes in their muscle-fields. In the area of compression the nerves are often nothing but fibrous bands, while above, they are thicker and softer than normal from congestion. Sometimes they are nodular from irregular compression.

The symptoms, in rapidity of onset and severity, depend upon the degree of ischemia present and its duration. In the severe cases, the symptoms are prompt in appearance and very characteristic. Almost immediately after the application of the tight dressings the patient makes vigorous complaint of pain. If the splint is not promptly removed, the pain increases in severity, marked swelling occurs in the hand and fingers, together with purple discoloration and the formation of skin-blebs. Within twenty-four hours the hand assumes the claw-shape resulting from contracture of the damaged flexor muscles, and if the dressing be not then removed, necrosis of the skin and flexor muscles is very apt to occur a short distance below the elbow (60 per cent. of Schramm's cases).

On removal of the splint, the flexor muscles are very hard and board-like to the touch, and the extremity is in characteristic position. The elbow is slightly flexed, the forearm pronated, the wrist slightly flexed, and the fingers strongly flexed in the claw-hand position. When the wrist is extended as much as possible, the fingers cannot be extended by any degree of force short of that sufficient to break the bones or rupture the tendons. When the wrist is fully flexed, the fingers may readily be extended by passive motion, although in bad cases this extension may not be complete. When the wrist is extended the fingers automatically flex and cannot be prevented from doing so by any degree of resistance. All attempts at extension, in whatever position, cause the cicatrized muscles to spring into prominence between the internal epicondyle and the front of the wrist. In the severest cases the contracture is sufficient to drive the fingernails into the palm of the hand.

When the nerves (usually median and ulnar) are primarily damaged by the ischemia, there is loss of sensation and paralysis of the muscle-field, which is partial or complete, according to the degree of nerve injury. When the nerves are not primarily involved they are very apt to undergo degeneration from compression by the cicatrization of the muscles. In either case, when nerve damage is present, there will develop trophic changes (blue, cold, glossy, thin skin), and mus-

cular atrophy in the nerve-field, in addition to loss of sensation and paralysis.

In less severe cases the symptoms develop more slowly.

Diagnosis.—When, after the application of firm dressings to a fractured extremity, there appear rapidly and simultaneously, pain, swelling, discoloration, flexion-contracture of the fingers and wrist, with loss of power to extend them either actively or passively, ischemic paralysis is present. Paralysis due to nerve injury is very different. Here the muscles are flaccid, permit passive motion through the full range, and contracture when it does occur is late in appearing and slow in development. The characteristic features then, of ischemic paralysis, are the rapid and simultaneous onset of loss of function, flexor-contracture, and rigid resistance to passive extension.

It is important, both for purposes of prognosis and treatment, to determine whether the nerves have been involved either early or late in the process. If the muscle responds, even though very faintly, to both faradic and galvanic current, there is no nerve injury. If the muscle responds to galvanic but not to faradic current, there is nerve injury. If the muscle responds to neither galvanic nor faradic current, there is complete muscle injury; nerve injury not determined. In this last contingency help may be derived from the examination of the muscles of the hand (interossei, lumbricales, thenar and hypothenar groups) which are very seldom or never involved in the ischemic lesion. According to the reactions of these muscles, it can be determined whether or not nerve impulses pass through the damaged area above, and therefore whether the nerves themselves are damaged.

Prognosis.—The prognosis varies not only with the degree of muscle and nerve damage, but depends decidedly upon the promptness and energy of treatment. In general the prognosis is unfavorable. Where the muscle has been entirely cicatrized there is no hope whatever. When only a small portion of muscle has been involved, proper treatment may

result in complete or nearly complete cure. Between these two extremes there are many degrees of recovery.

Treatment.—Bearing upon the subject of treatment are certain important facts derived from experimental research. Lapinsky caused ischemia in dogs' legs by tying the chief arteries. If the collateral circulation was allowed to develop, power slowly returned in the paralyzed muscles without inflammatory reaction. When, however, blood was allowed to return rapidly into the vessels weakened by prolonged absence of oxygen, effusion, swelling, and interference with the return of power in the muscles occurred. Leser caused ischemia in dogs' legs by tight splints. When the ischemic contracture had developed, if the splint was removed and the dog allowed to run free, the muscles soon returned to normal condition. If the limb was immediately re-immobilized, whether with a tight or loose dressing, a permanent contracture developed. This means that activity of the muscle substance so improves its circulation and nutrition as to prevent the degenerative changes which follow continued immobilization.

Treatment, based upon the sequence of pathological changes and the results of experimental work, must be early and vigorous. The longer ischemic paralysis has existed, the more difficult it is to cure; in fact, other things being equal, the success of treatment varies almost inversely as the time elapsed since injury. The cicatrization of the muscles, which is the essential feature of the condition, becomes more complete the longer the contracture exists. Prophylaxis is most important. No tight primary dressing nor any form of treatment which would cause circulatory obstruction should be applied to any fracture, especially in children when it involves the region of the elbow-joint, for this combination of circumstances is present in 96 per cent. of the reported cases. In every form of dressing allowance must be made for post-traumatic swelling. Frequent inspection or report, at intervals of not more than four hours, should be insisted upon for the first twenty-four hours. The dressing should be promptly removed if the patient complains of increasing pain, or if

swelling or discoloration appear with or without beginning flexor-contracture.

In every case reported in the literature, the removal of the primary dressing has been followed by the application of another, which, while looser, has continued the immobilization of the muscles. In the light of Leser's experiments this is faulty treatment. Not only should the primary dressing be removed but massage, electricity, active motion if possible, vigorous passive motion, under an anesthetic if necessary, should be used to restore the circulation in the damaged muscles. During these procedures proper support should be given to the fracture by an assistant, and afterwards the extremity should be lightly bandaged to prevent too much effusion into the damaged muscles. These measures should be repeated every few hours until the muscles are in good condition again, when attention may once more be directed to the fracture itself. Even if this treatment should result in malunion, non-union, or pseudarthrosis, either of these conditions is much less troublesome and more easily corrected than an ischemic contracture.

After the condition is once present, there is a choice between non-operative and operative treatment. Non-operative treatment consists in baths, massage, electricity, and passive motion. Some authors advise repeated strenuous extensions of the wrist and fingers, under an anesthetic if necessary.

Martin (C.) reported a case in which continuous slow elastic traction gave a most satisfactory result in a comparatively short time.

Sayre (R.) recently showed a case (see bibliography) where a very good result was obtained after using mechanical extension for six months. In both these cases the contracture did not appear for some six or seven weeks after the injury and it would seem probable that not so much of the muscle substance was damaged as in the cases with more rapid onset. Therefore a favorable result might be expected.

In severe cases, where the circulation is more seriously

damaged, these mechanical appliances involve a degree of risk, for pressure sores occur upon slight provocation.

Non-operative treatment is tedious, difficult, and the majority of results reported are not satisfactory. It gives no relief to compressed nerves.

Operative treatment gives quicker and more complete results according to the statistics of the published cases. In many of the operative cases palliative treatment had been tried for long periods of time without result.

There are two operative procedures each of which has its advocates: Tendon-lengthening, in which the flexor tendons are elongated sufficiently to permit complete simultaneous extension of the wrist and fingers. Advantages—no shortening of the forearm; no chance of mal-union, non-union, or pseudarthrosis. Disadvantages—operation is tedious; tendons may become mixed, adherent to each other and to the skin cicatrix, thus limiting mobility; the nerves may be injured or divided and sutured by mistake to tendon, as has happened in some of the reported cases.

To minimize adhesions to the skin some operators make a U-shaped flap with the convexity upward.

Resection of both bones of the forearm was first advised by Henle in 1896. Enough (1.5 to 2 cm.) is removed to permit complete extension of the wrist and fingers simultaneously. (See appended case-history.) Advantages—operation is short; avoids adhesions of tendons to each other and to skin; avoids damage to nerves. Disadvantages—forearm is shortened; there is possibility of mal-union, non-union, or pseudarthrosis. (Non-union has been reported once.)

Both operations have given good results and both ultimately act in the same way by eliminating the deformity, increasing the range of passive motion, relieving the extensor muscles from overstretching, and placing the flexor muscles under conditions most favorable to regeneration. The ultimate result depends on the amount of muscle regeneration in the cicatricial area. The greatest stimulus to regeneration comes from voluntary contraction of such muscle as is left.

Both operations, by relieving the tension, not only favor such voluntary contraction, but greatly increase the circulation and nutrition of the muscle.

While tendoplasty has its warm advocates, most operators are turning to resection of both bones of the forearm because it reaches the same result by a shorter, simpler method. The danger of non-union is small, and the slight shortening causes no functional disturbance.

In every case presenting signs of nerve compression, whether primarily or secondarily, the nerves (median and ulnar) should be released. Freeman, who especially emphasizes the frequency and importance of nerve lesions in these cases, advocates transferring the nerves to a subcutaneous position, or excising some of the cicatrized muscle to allow more space for the nerve in its natural position.

When the flexor muscles have been completely changed to fibrous tissue, of course no procedure can cause regeneration. Since, however, it cannot be determined clinically when the muscle is entirely gone, no case should be denied the benefit of the doubt and refused the operation.

Even in cases which give no hope of the return of motor power, much can be done to relieve trophic and sensory disturbances by neurolysis.

In the report of the two cases involving the foot and leg, subcutaneous tenotomy of the flexor tendons relieved the talipes equinus and gave a useful leg, although flexor power was entirely absent.

In two cases in the forearm, tenotomy of the flexors was done at the wrist, with the result of making a better looking but perfectly useless extremity.

As soon as the tendons or bones, according to the operation done, have firmly united, baths, massage, electricity, and passive motion should be employed vigorously and systematically until function has been restored to the muscles. Active use of the extremity should be encouraged at the earliest moment.

The object of after-treatment is to cause absorption of

cicatricial tissue and regeneration of muscle tissue. In the case reported below, progress seemed to be materially aided by preceding the bath and massage by congestive hyperemia for one to two hours, and combining the inunction of mercurial ointment into the cicatricial area with the massage.

Hope must not be given up even if no apparent progress is made for months, as these cases are invariably tedious, especially when the nerves have been involved.

CASE HISTORY.—Louis K. fell and broke the lower end of the right humerus on May 5, 1906. He was 4 years, 9 months old. One hour after the injury a plaster splint was applied. The next day the extremity was very painful and the hand was swollen, cyanotic, and covered with large blebs. The pains gradually subsided. On the seventh day, when the splint was first removed, there was an abscess involving the skin and flexor muscles just below the elbow, and a well marked, rigid, flexor-contracture of the wrist and fingers. The abscess was treated and the splint replaced. After four weeks the splint was discarded and the abscess was still discharging.

For eight months massage, electricity, passive motion, and vibration were tried with absolutely no benefit. Then, January, 1907, thinking the trouble was due to inclusion of the musculospiral nerve in the callus, an incision was made over the nerve at the outer side of the elbow. The nerve was not involved. The previous treatment was continued until June, 1907 (13 months), when he was referred to me by Dr. S. A. Twinch, who was not, however, responsible for the treatment of the original fracture.

Physical Examination.—A boy, slender, blonde, and in good general condition. The right arm is freely movable in all directions at the shoulder. There is moderate convex deformity above the external condyle of the humerus, result of the old fracture, resembling gunstock deformity. There is a linear scar over the outer aspect of the elbow from the incision over the musculospiral nerve. Just below the elbow on the flexor surface is the scar of the old abscess, 4 x 2 cm. The hand is cold, blue, with thin, shiny skin, and with trophic disturbances of the finger-tips, as indicated by thickened, corrugated nails, and red, shiny skin,

showing a tendency to ulcerate, especially on the tips of the index and middle fingers. The forearm, wrist, and hand are rigid, with the wrist flexed about 20°, the metacarpo-phalangeal joints slightly extended and the remaining finger joints about half flexed. It closely resembles "main-en-griffe." An unyielding, rigid band runs along the flexor aspect of the forearm from the internal condyle of the humerus to the wrist, which becomes more prominent on attempting to extend the wrist and fingers, and evidently prevents such extension. This same band prevents full extension of the elbow. All the flexors of the fingers are apparently involved in this cicatricial mass.

Active Motion.—Absent in the wrist joint. Very slight power of extension at the metacarpo-phalangeal joints. The extensor muscles contract definitely but cannot overcome the flexor contracture. The musculo-spiral nerve is therefore undamaged. The fingers spring back to their positions instead of being drawn back by flexor contraction. The fingers cannot be flexed.

Passive Motion.—The wrist can be fully flexed and, when held in this position, the fingers can be fully extended on the hand. When the wrist is brought back to the limit of its extension, the fingers, pari passu, resume their flexed position and no amount of force can prevent them from doing so. When the wrist is held at its limit of extension, the fingers can be fully flexed but can be extended only very slightly beyond the position they naturally assume when left alone.

There is atrophy of the interossei, thenar, and hypothenar muscles, and this, together with the trophic changes in the fingers, indicates that both the ulnar and median nerves are damaged.

Operation July 6, 1907. Ether. A 10 cm. longitudinal incision was made over the middle of the forearm just below the elbow. The flexors, superficial and deep, seemed to be entirely fibrous. An incision was made through them to expose the median nerve. They were mostly fibrous tissue with a few muscle fibres scattered here and there. There was but little bleeding. The median nerve, beginning where it passes between the two heads of the pronator radii teres, was compressed, thin, and white for a distance of 5 cm. downward. Above this area the nerve was much thicker and more congested than normal, while below, it was about normal in size and appearance. The

nerve was freed and wrapped in Cargile membrane. The ulnar nerve was compressed but not so much as the median. It was treated in the same way. The muscles were lightly sutured with catgut and the skin closed with silk.

By the subperiosteal method, 2 cm. of each bone of the forearm was removed; in the ulna 5 cm., and in the radius 7 cm. above its lower end. Different levels were chosen to avoid possible difficulty from cross union, and also to make it easier to hold the bones in position. The bones bled freely.

With the bones thus shortened the wrist and fingers could be extended simultaneously and fully. The marrow canals of the bones were too small to permit the use of Elsberg aluminum tubes inside, so tubes just large enough to receive the bone-ends were fitted in subperiosteally, the bones slipped into them and the periosteum sutured over them with catgut. The skin was closed with silk without drainage. The extremity was put up on an anterior splint with the fingers and wrist fully extended. All the wounds healed by primary union.

Post-operative History.—August 24, seven weeks after operation, the bones are firmly united. There is a fusiform swelling over the aluminum tube on each bone. Splint was discarded. The wrist and fingers can be fully and simultaneously extended by passive motion.

October 30 (3 months, 24 days). There is some return of the flexion contracture of the wrist and fingers. Marked improvement in the warmth, color, and nutrition of the hand. The thumb can be adducted and slightly flexed voluntarily. The fingers can be slightly moved by the extensors, but flexed only by the interossei so that the distal joints extend while the metacarpophalangeal joints flex. Fusiform swellings still persist at the points of resection.

February 3, 1908 (7 months). The contracture at the wrist and fingers has slightly increased. The interossei and thenar muscles are distinctly less atrophied and the thumb can be slightly flexed and well adducted so as to firmly grasp things between it and the side of the index finger. The little finger can be slightly flexed. The index, ring and middle fingers can be flexed only at the metacarpo-phalangeal joints, by the interossei muscles. All the digits can be slightly extended voluntarily. The elbow can

FIG. 1.

X-ray picture taken nine months after operation for ischemic paralysis. 1. Site of resection of the radius, showing the aluminum tube still in the callus. 2. Site of resection of the ulna, showing the tube more distinctly and a larger callus. The perfect alignment of both bones obtained by using tubes is clearly shown.

be extended a little more than before operation. The cicatricial mass seems to have diminished a little in size and rigidity. The fusiform swelling over the radius has entirely disappeared; over the ulna, the swelling is much larger as the result of a fall a few days ago. (Fig. 1.)

March 6, 1908 (8 months). The swelling on the ulna is much diminished. The hand is normal in color, temperature, and trophic appearance of the skin, and the interossei, thenar and hypothenar muscles are evidently returning to their normal size. Voluntary extension of the fingers is stronger. There is slight flexion of the fingers apparently by the long flexors.

In this case the history was characteristic and the onset was sudden, as indicated by the appearance, within twenty-four hours, of swelling, cyanosis, and skin-blebs of the hand. Abscess of the flexor muscles indicated a severe case. Non-operative treatment was carried out vigorously and systematically for thirteen months with absolutely no benefit. Operative treatment was then tried as offering the only hope left, although this was small. After eight months, there is slight improvement in mobility of the wrist and fingers, the appearance of very slight power to flex the tips of the fingers, marked improvement in power and movement of the thumb, development of the interossei and thenar muscles, and the return of normal trophic conditions to the hand and fingers.

The greatest improvement has occurred in the last two months, so that there is much to hope from the future of the case.

Summary.—Ischemic paralysis is essentially a myositis resulting from prolonged absence from the muscle of oxygenated blood. Muscle substance is replaced by fibrous tissue in proportion to the severity of the case, with a corresponding degree and rigidity of contracture.

The nerves are frequently involved, either primarily from the ischemia and pressure, or secondarily from compression by the cicatricial mass. This form of paralysis occurs, nearly always, in the forearm after too tight dressings have been

applied to fractures near the elbow. The great majority of cases occur in children from three to twelve years old.

Diagnostic Symptoms.—Early onset of severe pain and swelling; simultaneous appearance of rigid contracture with the paralysis of the muscles, causing the characteristic "claw-hand." The simultaneous appearance of the contracture with the paralysis differentiates these cases from palsies due purely to nerve lesions.

Severe cases may result from six hours of tight compression.

Evidence of damage to nerves should always be sought.

Treatment.—Prophylaxis is most important. No tight dressings should be used on any fractures, especially when they are near the elbow-joint in children. In all dressings allowance must be made for traumatic reactionary swelling. Frequent inspections of dressings must be made for the first two days after injury.

When the lesion occurs, dressings must be removed, the fracture neglected for the time being, and attention paid solely to the return of muscle nutrition and function.

Non-operative treatment consists in the use of massage, electricity, vigorous passive motion, etc. (so-called physical therapeutics).

Operative Treatment.—Lengthening of the tendons of the shortened muscles sufficiently to permit simultaneous extension of the wrist and fingers.

Resection of both bones of the forearm is a simpler and probably a better operation. Enough is removed to permit full extension of the wrist and fingers.

Either operation relieves the excessive tension and favors muscle regeneration.

In all cases damaged nerves should be properly cared for.

After-treatment consists of physical therapeutics and must be vigorously and systematically applied.

Prognosis is on the whole unfavorable; complete cure is rare; improvement often comes only after months or years of steady work.

Results are better the earlier and more vigorous the treatment.*

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* It was brought out in the discussion by Dr. Erdmann at the New York Surgical Society that the gradually returning contracture of the wrist and fingers was due rather to the growth of the bones of the forearm than to further contracture of the cicatricial mass of muscles.

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Case 1.—Girl, 10 years old; fracture of both bones of forearm; almost perfect result.

Case 2.—Boy, 19 years old; injury of fleshy part of forearm without fracture; improvement.

Case 3.—Boy, 16 years old; fracture of olecranon; observed only for one month, but there was improvement in sensation.

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Sayre (R.). Case presented before the Pediatric Section of the New York Academy of Medicine, March 12, 1908. Girl, 16 years old; fractured both bones of the forearm in 1906; splints for four weeks; contracture well developed at seven weeks; massage and electricity for many months without any effect. In Sept., 1907, when the hand still showed well-marked "main-en-griffe," Sayre began continuous traction and extension by apparatus, with massage and passive motion at frequent intervals. After six months the wrist and fingers can be extended simultaneously, and the thumb can be apposed to most of the fingers.

RECURRENT DISLOCATION OF THE ULNAR NERVE.

REPORT OF A SECOND CASE CURED BY OPERATION.

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In the Annals of Surgery for November, 1903,* I reported a case of recurrent dislocation of the ulnar nerve cured by operation together with a summary of all operations reported up to that time, fifteen in number. The rarity of this condition and the small number of cases operated upon call for a report of every case. I therefore wish to give the history of a second successful operation and in addition to present a brief review of what has been written on this subject and of the cases operated on since my last paper was published.

The ulnar nerve rarely dislocates forward of the condyle of the humerus, whereas subluxation to the tip of the condyle is not infrequent. About 3 out of 200 cases will show dislocation of the nerve, but the cases in which this dislocation causes painful and disabling symptoms are much rarer. Subluxation almost never causes pain. I have been interested in this subject and have been on the lookout for such cases for the past nine years, during which time I have been on duty at least eight months of each year in a large clinic at the Massachusetts General Hospital. These two cases,—the one previously reported and the one reported below,—are the only ones which have come under my observation, and so far as can be discovered are the only ones in the records of this hospital.

* Report of a case of recurrent dislocation of the ulnar nerve cured by operation. With summary of previously reported cases.

The recurring dislocation of the nerve on flexion of the elbow may be a congenital or habitual condition which does not lead to annoying symptoms. In these idiopathic or non-traumatic cases the dislocation is seldom accompanied by sufficient symptoms to demand operation. If symptoms do appear they yield to palliative treatment in most instances. In the few cases operated upon only two have been the congenital or habitual forms; in all the other operated cases the symptoms have resulted from trauma. The kind and degree of trauma to the region of the elbow causing the lesion are various. Direct violence, such as contusion and hæmatoma of the soft parts, has been followed by recurrent dislocation; indirect violence, such as exercising on a parallel bar or throwing a snow ball, has been sufficient to tear up the fibrous structures normally tying down the nerve and permit of the abnormal mobility. Diffuse suppuration around the elbow also has been followed by dislocation.

The majority of the cases operated upon have followed more or less severe direct violence either from blows or falls. My first case struck the inner side of the left elbow violently against a post, without, however, any bony fracture, about a month before symptoms due to dislocation of the nerve appeared; my second case, reported below, followed a septic wound at the inner side of the elbow and an incision for drainage of a large collection of pus. A case reported by Croft was also that of a young woman with septic infection in the region of the elbow following an injury.

The characteristic symptoms are severe darting pain at the region of the elbow into the distribution of the ulnar nerve in the hand. Numbness and tingling in the inner fingers of the hand may be present all the time, but flexion of the forearm causes a severe shooting pain from the elbow into the fingers. In both my cases flexion and extension of the forearm caused pain referred to the internal condyle of the humerus and inner side of the forearm and the two inner fingers of the hand. There was no loss of sensation in the region supplied by the ulnar nerve, the strength of the hand

was good and there was no muscular atrophy. There was entire disability for any form of work necessitating the use of the affected arm.

It is the accepted theory of nearly all who have reported cases of this condition that the darting pain along the course of the nerve is caused by the trauma of the oft-recurring excursions or jumps over the tip of the internal condyle, and that in a comparatively short period of time pathological changes in the nerve and its sheath take place. In most of the cases operated upon the nerve was found to be distinctly enlarged and fusiform in shape. The only case in which a microscopic examination of the nerve structure has been made was in the case of Andrae, which was summarized in my previous paper. Acting on the theory that the dislocation was due to the excessive length of the nerve caused by stretching Andrae excised the fusiform enlargement and sutured the ends of the resected nerve together. Examination of the excised piece showed a typical neurofibroma with marked thickening of the nerve sheath.

For a complete review of the subject as well as abstracts of cases reported previous to 1903 the reader is referred to my previous paper, also to the articles by Poncet, Haim, Schwartz, Rosenbach, Jopson, and Cotton, references for which are given in the bibliography at the end of this paper.

My first case was that of a man fifty-two years old. He was operated upon in 1900. Dislocation followed a blow as stated above. He had been disabled for six months. At operation the groove back of the internal condyle, in which normally the nerve should rest, was filled by muscle-fibres,—evidently a portion of the triceps. The nerve could be easily moved about between the points where it emerged from the intermuscular septum and passed between the two heads of the flexor carpi ulnaris. It was fusiform in shape and as large as a lead pencil in its thickest portion. There was no strong band of fascia passing over the nerve, the so-called arcuate ligament. It was evident that at the original injury the fibrous and muscular structures back of the condyle had been torn

or ruptured and in the process of repair the bony groove had been filled up with muscle-fibres.

The groove was cleared and the nerve replaced and a flap from the triceps fascia sutured over it to the fascia covering the flexor muscles. I have heard from him within a few weeks, eight years after the operation. He has remained absolutely free from any of the symptoms and has been able to engage in his occupation as lumberman.

Report of the Second Case.—M. H., a young Irish-American woman, twenty-two years old, single, domestic servant by occupation, was first seen by me early in June, 1906, in the out-patient department of the Massachusetts General Hospital. She was kept under palliative treatment for two months before it was decided to operate. Her previous history was as follows: In 1904 she had been an inmate of the hospital because of accidentally swallowing a large safety-pin. This was removed successfuly by Dr. Algernon Coolidge. One year before she came under my notice she had received a small lacerated wound at the inner side of the right elbow, which became infected and suppurated extensively for weeks. She was treated for this in the out-patient department. Soon after the infected wound healed she began to be troubled by numbness and pricking sensations in the fourth and fifth fingers of the right hand and shooting pain along the inner side of the right forearm starting from the elbow and continuing into the fingers of the hand. These symptoms at first did not bother her to any extent when she kept the arm still, but any motion involving flexion of the forearm at the elbow started up the severe pain. She had had an operation for the relief of these painful symptoms, which operation, so far as could be found out, consisted of dissecting out the scar of the old incisions for drainage, presumably on the theory that the symptoms were due to pressure upon the ulnar nerve. No relief was obtained from this treatment.

It was evident that the attendants in the clinic considered her complaints of pain as feigned, and I was informed that she was an old hysterical case and everything had been done that could be done for her symptoms, which were doubtless imaginary.

Examination showed a well-developed and nourished young

woman not markedly neurotic in appearance or conduct. The pupils were equal and reacted normally. There was nothing abnormal found in the heart, lungs or abdomen. There was a slight enlargement of the thyroid gland. Knee-jerks were normal. The right elbow was held in semi-flexion. Motions of the joint were possible, both flexion and extension, but caused complaint of severe pain at the inside of the elbow darting along the inside of the forearm and into the hand. On the inside of the arm over the course of the ulnar nerve was a wide dense scar about four inches long. The lower end of the scar was about two centimetres above the internal condyle of the humerus. The scar was readily movable over the underlying tissues. The ulnar nerve could be felt, with the arm in extension, in its groove back of the condyle, upon flexion it dislocates well forward of the condyle. The nerve was evidently enlarged and could be felt to the upper and outer side of the scar on the arm and could be traced for at least an inch and a half further than in normal arms. Pressure upon the nerve back of the condyle, and also where it was exposed under the skin upon the arm, caused extreme pain at the site of pressure and referred pain into the fingers.

There was no disturbance in sensation in the ulnar distribution in the hand nor was there evident loss of strength in the hand or muscular atrophy. Because of the suspicion of neurasthenia in the case, although the symptoms and signs of nerve dislocation were sufficiently plain, I was persuaded to try palliative treatment for a longer time than usual. The arm was put on an internal right-angled splint for three weeks. While it rested on the splint there was no acute pain, but some prickling sensations and numbness in the fingers persisted. At the end of three weeks upon removing the splint there was just as much pain, both local and referred, upon pressure and attempts to use the arm caused severe pain. It was impossible for her to use a broom in sweeping or to do any household work which called for flexion of the forearm at the elbow. A second period of rest for three weeks made no change in the conditions. At the end of two months' palliative treatment I became convinced that this was a case of actual disability from recurrent dislocation of the nerve, and also that it was a case in which, because of extensive suppuration and previous operation, the nerve had even more freedom than is found usually. The movement of the nerve in the arm, as the forearm was flexed, was marked. Either by the suppuration or previous

operation the nerve had been freed from its normal place under the aponeurosis of the triceps and was subcutaneous for an abnormal distance. Accordingly I operated upon the patient on the 15th of August, 1906.

The old scar was dissected out and it was found that the nerve was exposed for a distance of about two inches above the groove in the condyle and at the point where it entered the aponeurosis over the triceps muscle it was bound down firmly by scar-tissue. Between this point and the groove it was enlarged, reddened and freely movable. The fibrous tissues normally pinning the nerve down into the groove behind the condyle were not defined, a condition which meant that with every flexion of the forearm the nerve was displaced forward over the condyle and also pulled upon at an acute angle where it emerged from the intermuscular septum.

The nerve was buried as nearly as possible in its normal position by making a new fibromuscular canal, suturing the nerve under the fibres of the triceps muscle and also turning over a flap from the aponeurosis of the triceps and suturing it to the fascia over the flexor group. The wound was closed without drainage and the arm put up on an internal right-angled splint. At no time after the operation was there complaint of pain. The splint was removed at the end of three weeks and active and passive motion begun without bad result.

I saw the patient over a year after the operation. She has been at all times free from pain and disability, has married and is able to do her own housework.

Emil Haim (Ueber Luxation der Ulnaris, *Deutsche Zeitschrift für Chirurgie,* Leipsic, 1904, lxxiv, 96) reported two case, one operated on by Lotheisen and one case of Von Hacker personally communicated to Lotheisen, a case operated on at the Innsbrücker clinic. Haim in common with certain other German writers discusses at some length the question of a predisposing cause in the non-traumatic cases. He thinks that the dislocation is never congenital and that a predisposition exists. He, as well as Cohn, advances a new theory which is worth mentioning, although it is hard to attach much importance to it as the cause of the dislocation. He places great

stress on the carrying angle at the elbow, that is, the angle which the forearm makes with the humerus in extension, the *cubitus valgus,* and he thinks it has been proved by a study of many patients that this angle is less in those cases in which the ulnar nerve dislocates. He found in men with normal ulnar nerves that this angle was from 170 to 178 degrees; in women 165 to 175. In the cases in which the subluxation or dislocation of the nerve was present the angle was about 5 degrees less.

The case of VON HACKER is of special interest because of the dislocation of the nerve caused by tuberculosis of the internal condyle. The progress of the disease pushed the nerve forward out of its normal position permitting recurrent dislocation with the typical pain and disability. After dissection of the epitrochlear glands and removal of some diseased bone, the nerve was sutured under a bridge of fascia, with an excellent result so far as the relief of the pain was concerned. No other details of this case are given.

LOTHEISEN'S case was one of traumatic dislocation of the *right ulnar nerve* following a blow on the elbow. Operation and recovery. Two years after, operation on the *left nerve* for the same condition. School boy, sixteen years old. No previous trouble in the region of either elbow-joint. Five days before fell, striking on right elbow. Immediately felt severe pain in the elbow and darting pains into the two inner fingers of the right hand. The painful symptoms persisted.

Examination: Normal in every way except in regard to right elbow. The ulnar nerve could be felt as a distinct cord forward and inside of the epicondyle, and pressure on this cord caused severe pain at the elbow and into both inner fingers of the right hand. Upon extension of the forearm the nerve returned to its normal situation. It was noted that the left nerve was somewhat freely movable,—that is to say, there was subluxation. X-ray photographs showed that on both sides the epicondyles were normal and even larger than usual. On both sides there was a marked cubitus valgus. The measurement of the carrying angle was 165 degrees.

Operation December 15, 1902. Ethyl chloride anæsthesia. A straight incision over the internal condyle. The nerve appeared normal. It was placed in its groove and a flap of fascia sutured by four silk stitches to the periosteum and edge of the bone,—how is not stated. Skin wound closed without drainage. Arm put up on a splint in extension. After ten days some careful passive motion of the joint, and after fourteen days the arm placed upon a right-angled splint. At the end of three weeks the patient left the hospital without pain. Seven weeks after the operation he was well. (Note the early date at which motion of the elbow was attempted.)

A second operation was done by Lotheisen on this same patient on the other elbow July 14, 1904, about two years after the first injury. While at work suddenly felt a sharp pain in the left elbow and left hand exactly similar to what he had had on the right. By self-examination he noted that the nerve dislocated on each flexion of the forearm. Examination discovered typical dislocation as at the other elbow. A similar operation was done save that the flap of fascia was sutured over the nerve to the edge of the triceps muscle. No after-treatment or result is given, except that on flexion the nerve remained fixed in its normal position.

Rosenbach (Ueber die Luxation des Ulnarnerven, *Deutsche Zeitschrift für Chirurgie,* Leipsic, 1906, lxxxv, 300) from the polyclinic in Göttingen reported a successful operated case and gave a concise review of the subject. In regard to the frequency of complete dislocation he gives the observation of the following men: Raymonenq found no case in 300 persons; Kissinger, 1 case in 200; Haim, no case in 350; and Momberg found 23 cases in 116, all in soldiers. Subluxation of the nerve is not infrequent. Kissinger found this in about one-third of the cases.

In my previous paper I stated that in a series of 150 large and well-developed men I found only 1 case of complete dislocation, but that in over one-third of the cases subluxation was present. These subluxations are not infrequently bilateral and almost never cause painful symptoms. Almost all the German and French writers give a good deal of space to the reasons for complete dislocation of the nerve. The practical points are that there must be some predisposing reason for the dislocation in those cases in which traumatic causes can be eliminated. The connective-tissue fibres from the aponeurosis, the so-called arcuate ligament which binds the nerve down in its groove may be weaker and looser in some persons than in others. This may be a congenital defect or due to conditions of ill health or emaciation. The triceps muscle may be larger than usual and take its insertion lower down so that on flexion of the forearm there is more of the bulging of the muscle tending to push the ulnar nerve out of its place. Again the condyle of the humerus may be smaller and less prominent in certain individuals. Fortunately in all but two or three of the non-traumatic cases of complete dislocation no

operation has been necessary and in those cases in which temporary painful symptoms have been present these have yielded readily to palliative treatment. The serious cases, those demanding operation, are usually the ones in which some definite trauma is the cause, either a blow or some violent motion of the elbow-joint.

Report of ROSENBACH's Case.—A strong woman, eighteen years old, after exercising on a horizontal bar noticed that she could not move her right arm at the elbow without great pain. Applied ice and iodine, and had massage. Wore plaster of Paris bandage for two weeks. On examination complete dislocation of the ulnar nerve was found, with characteristic pain.

Operation seven weeks after the first symptoms discovered that the nerve was enlarged and reddened. The nerve was fixed in its groove by the following method: The groove in the bone was deepened by a gouge before the nerve was replaced. After this a flap of fascia from the triceps was sutured over the nerve to the fascia over the insertion of the flexor group. His reason for gouging out the groove was that he was afraid it would require too great force to hold the nerve in place. No details of the after-treatment are given. The operation cured the patient.

HOLM, A. (Et Tilfaelde af Luxatio traumatica nerv. ulnaris., Hosp. Tid., Kbenh., 1906, 4 R. xiv, 461–468), reported a case operated on in Poulsen's clinic in Copenhagen, November 28, 1905, as follows: Case of a carpenter, seventeen years old. At eight years of age had dislocation of the elbow; at end of half a year all motions good, no further trouble. Ten days before entering clinic while flexing the forearm was struck a blow which knocked the inner side of the elbow against a table. There was immediate characteristic pain at the elbow, shooting into the finger, with increasing pain and disability. Poulsen used a small flap from the periosteum as well as a flap from the aponeurotic structures, suturing over the nerve with catgut stitches. The arm was put in extension, fixation bandages. In three weeks nerve held firmly in place, joint motions normal. There was no more pain, but on extreme flexion of the elbow there was a slight grumbling sensation in the fingers.

G. Tisserand (Luxations du nerf cubital, Arch. gen. de méd., Paris, 1906, 1, 86–91) is opposed to this method, which covers the nerve with a periosteal flap. He thinks that in this there is danger of pressure on the nerve ultimately, especially in young persons, from proliferation of bone; the flap from the aponeurotic structures is all that is necessary. In this opinion I agree entirely.

Blanc and Tisserand (Un Cas de Luxation du Nerf Cubital, La Loire Méd., St. Étienne, 1905, xxiv, 27–30) have reported one operated case as follows: Workingman, seventeen years old. Two months before in making a violent effort to lift a heavy weight from the ground, felt sudden pain in the left elbow at the moment of flexion of the forearm, "as if a nerve was torn." For the next month and a half each movement of flexion of the forearm caused pain which was not severe or disabling until fifteen days before operation, when the severity and the weakness in the hand compelled him to give up work. Nothing is said about the distribution of the pain into the hand at this time.

Examination: The region of the elbow showed no wound or abnormality when the forearm was extended. The motions of the joints were normal. In flexion it was noticed that when the forearm was brought to a right angle on the arm one could see in bold relief under the skin a cord jump suddenly from the posterior to the anterior face of the epicondyle. At this time the patient complained of lively pain along the internal border of the forearm and in the elbow-joint. Pressure on the displaced cord caused severe pain in the forearm, radiating into the ring finger and little finger. On palpation the groove back of the condyle was found empty. On extending the forearm the nerve was seen to jump back suddenly to its posterior position. There was no anæsthesia in the nerve distribution and no muscular atrophy. The electrical reactions were normal. The ulnar groove was filled with fibrous tissue. This was removed and the nerve put back in the groove and fastened by a small flap of fascia from the aponeurosis which was sutured to the triceps muscle. Skin sutured without drainage and arm fixed in extension. Union by first intention. No pain since operation at any time. (Note.—On the tenth day passive motion was made and the forearm put up in half flexion, and in eighteen days brought up to a right angle and at each change of position passive motion of the elbow-joint was done.)

The man was discharged cured December 20th, just a month after operation. All the movements of the forearm were free and without pain. The ulnar nerve remained in its groove. This patient had a persistent zone of hyperæsthesia in the distribution of the ulnar nerve along the border of the ring finger and the hypothenar eminence.

Up to 1904 only 15 operations for this condition had been reported. Abstracts of these cases together with a report of my first case were given in the previous paper, 16 cases in all. Since 1904 it has been possible to find only 6 additional cases with my second case now reported, bringing the total number of operations to 23. A study of these cases justifies the following conclusions:

Operation for this condition has every chance of effecting a cure. Only the severe cases, few in number and for the most part traumatic, need ever be operated upon.

Operation should never be undertaken for dislocation of the nerve alone, but only for the severe and disabling symptoms caused by the recurring dislocation.

The simple operation of replacing the nerve in its groove and covering it over with a flap of fibrous tissue from the triceps fascia will be sufficient to hold it firmly in place. More elaborate operations of chiselling the bone or dissecting up periosteal flaps are unnecessary.

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THE OPERATIVE TREATMENT OF RECENT FRACTURES OF THE FEMORAL SHAFT.*

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As a preliminary step in this undertaking, it seemed wise to determine as accurately as possible the range of discrepancy in the length of the lower extremities of normal adults.

It is generally believed that a difference of an inch or even more may exist in the measurement of normal limbs.

Accordingly fifty subjects were carefully measured for me by Mr. Sterling Bunnell, a senior student of the University of California, who submitted the following data:

The greatest discrepancy in any individual amounted to ¾ of an inch (1.9 cm.).

Average discrepancy in 50 subjects proved to be slightly under ¼ of an inch (.58 cm.).

Discrepancy exceeded ½ inch in 3 subjects (6 per cent.).

Discrepancy equal to .39 of an inch (1 cm.) in 10 subjects, 20 per cent.

Right leg longer than left 18, 36 per cent.; left leg longer than right 25, 50 per cent.; legs equal 7, 14 per cent.

Hence it appears that in dealing with thigh fractures discrepancy in length of normal limbs exceeding one-half inch is to be reckoned with in only six per cent. of all cases and that only in one per cent. of cases will the difference amount to ¾ of an inch or more.

As a secondary step I formulated a circular letter embodying the following queries, which was sent to all members of the American Surgical Association and to other surgeons of this country and Canada:

1. What is your interpretation of the term "tolerable result" (*i.e.*, satisfactory functional result) in fractures of the Shaft of the Femur?

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* Read before the Medical Society of the State of California, April, 1908.

2. What degree of shortening is compatible with satistory function?

3. Is a definite amount of overriding of fragments permissible from the modern standpoint?

4. Are you satisfied with the average results attained by conservative (non-operative) treatment?

5. Are you an advocate of operative treatment as a routine iniative measure?

6. In operative procedure do you employ wire, nails, screws, staples or such an appliance as Parkhill's clamp?

7. Do you regard the danger of infection as contraindicating the operative treatment of simple fractures?

8. Has it been your habit to secure X-ray evidence of end-results on fractures of the femur?

Ninety-two answers were received. The data obtained from this source will appear elsewhere under appropriate headings.

The motive of this paper is:

1. To determine finally, if possible, what shall be regarded as a satisfactory end-result in fractures of the femoral shaft.

2. To ascertain whether or not anatomical replacement, and permanent fixation of fragments by operative interference is justifiable from the standpoint of infection and of improved end-results.

It cannot be denied that results of conservative treatment in thigh fractures have not, as a rule, conformed to the high ideals which govern every modern surgical undertaking.

During the past two decades surgical activities have centred closely upon abdominal and visceral lesions, while interest and enthusiasm seem to have waned as regards fracture treatment in general. As a rule surgeons of acknowledged skill and broad experience have approached ordinary thigh fractures with a jealously guarded prognosis, a faintly cloaked confession of inability to restore normal relation and function; and, at the end, in a certain proportion of cases adroitly framed apologies for manifest defects or deformities have been too often a forced expedient.

In 1890 the American Surgical Association appointed a committee to determine what should be considered a satisfactory result in simple fractures of the shaft of the femur.

The committee was composed of the following well-known gentlemen: Dr. Stephen Smith of the University of New York chairman, Drs. D. Hayes Agnew, David W. Cheever, D. W. Yandell, Charles T. Parkes, P. S. Conner, Charles B. de Nancrede and Hunter McGuire.

Smith's report submitted in 1891 was based upon opinions sent in by thirty-five members and was sanctioned by the Association. It embodied an analysis and discussion of all points involved by the question at issue.

His conclusions, slightly abbreviated, are as follows:

A satisfactory result may be predicated when:

1. Firm bony union exists.
2. Correct axial relations are maintained.
3. Preservation of correct relations of the anterior planes of upper and lower fragments.
4. Shortening not to exceed one-eighth to one inch.
5. Lameness, if present, is not due to more than one inch of shortening.
6. When the conditions attending treatment prevent better results than those obtained.

The doctrines herein set forth have been almost universally accepted by surgeons in practice, and to a certain extent have been recognized by Courts in medicolegal procedures.

It is to be borne in mind that, in the opinion of most surgeons, "satisfactory result" is a very flexible term, applicable to widely varying conditions, while on the other hand, in every department of surgery, the exaction is for the nearest possible restoration of normal relation and function.

Bloodgood, of Baltimore, in a personal letter says: "Quite frequently with some shortening, due to overlapping or bending, patients are able to walk without special difficulty. I would call this a satisfactory result," and adds, "It is remarkable how good function may exist with a great deal of shortening, provided that axial relations are maintained."

Harry M. Sherman, of San Francisco, believes "the term 'satisfactory result' is capable of two interpretations; one for non-operative, the other for operative treatment," intimating that anatomical adjustment is more probable following the latter method.

My own feeling is that higher standards in fracture treatment should be maintained with a stricter compliance with anatomical requirements. *Nor do I fear, that in departing from traditions, we shall tread upon dangerous ground from the medicolegal standpoint.*

Since Stephen Smith set the pace, the science of radiography has unfolded many secrets affecting the status of fractures at all stages, and it is apparent that end-results which in former days did not challenge adverse criticism on the part of the patient, his friends or later professional attendants, are capable to-day of being shown to be, from the anatomical standpoint, faulty in the extreme.

Whenever the X-ray as an official aid is accessible, it has become an indispensable factor, and the documentary evidence from this source is valuable through every phase of fracture treatment.

With a large experience extending over a period of twenty-five years, I am free to confess, that without the aid of radiography, I am unable to determine with any degree of accuracy the status of many fractures at any time during the progress of repair. This is particularly true of fractures of the femur where fragments are deeply imbedded in muscular tissue, by which outlines are obscured and prominences are impossible of correct definition.

In fracture treatment the surgeon is confronted by three exactions: First, the re-establishment of normal relations (interlocking of fragments); second, maintenance of perfect alignment; third, avoidance of rotation. And it may be added that failure to meet any of these conditions upsets one's calculations as regards the other two.

Very many thigh fractures can be treated ideally under conservative methods. It is obvious that before operation is

to be considered, repeated and conscientious efforts at adjustment and permanent fixation must be made. Just as obviously, conditions attending certain fractures render them practically incorrigible from the standpoint of conservative treatment.

Von Bergmann refers to the accident statistics of Haenel as follows: of 121 fractures of the femur only 39 recovered fully. In 75 the injury was permanent with average loss of earning capacity of 28 per cent.

Fractures of the upper third of the femur are notably obdurate. Many years ago Erichsen stated that in fractures of the upper third of the femur results were invariably unsatisfactory.

In 1890 Allis, at the close of an exhaustive treatise upon "Fractures of the Upper Third of the Femur," makes this significant and manifestly too sweeping statement: "The conversion of a simple into a compound fracture offers the only means of accurate diagnosis, and the only method of rational treatment. Patients and surgeons who stop short of this must compromise with best results."

By the action of certain muscles the upper fragment is rotated outward and drawn upward, while other muscles acting upon the lower fragment separate it widely and assure overriding, rotation and deformity.

My own experience with fractures of the *middle third,* verified by repeated X-ray evidence, has convinced me that ideal adjustment is likewise difficult if not impracticable. Especially is this true of transverse fractures at this point. In several instances of this sort I have made repeated and conscientious efforts at securing apposition, and each time the radiogram through anteroposterior and transverse planes has shown wide separation and overriding.

I wish to emphasize that shortening to an appreciable degree in transverse fractures of the femur means invariably overlapping, a condition which my own standards do not tolerate; and further, that the nearest possible approach to anatomical reposition and correct alignment should be recognized as not beyond the requirements.

During the past two years I have treated conservatively four thigh fractures with the following results: one was positively intolerable because of overriding; two were imperfect but in the ordinary sense satisfactory; one was ideal.

Another consideration is of paramount importance. With overlapping, union is effected with far greater difficulty and at the expense of double the time required when anatomical replacement has been secured.

In my opinion, a very large percentage of all cases of delayed or non-union can be attributed to faulty adjustment.

It is true that untoward results will be manifest less often at the hands of men of supreme intelligence, men who are trained in the use of appliances and methods such as those of Bardenhauer.

I have gone over the volume on fractures by this distinguished author aided by the splendid illustrations which it contains, and I am strongly of the opinion that few patients would submit to confinement in a fixed position during a period of weeks or months.

Furthermore the matter of adjusting multiple traction appliances, exerting force in from two to six different directions simultaneously would involve the average surgeon in overwhelming difficulties.

Were it a fact that operations for the relief of impossible conditions, such as loss of function, persistent pain, delayed or vicious union were easily capable of correction by late operation, any argument for so bold a procedure as an initial operation would have less weight.

Long experience in dealing with this particular lesion, and frequent opportunities of inspecting and correcting unfortunate results, has led me to two conclusions:

1. That the so-called "tolerable" or "satisfactory" results are too often either intolerable or unsatisfactory; overriding of fragments, shortening sufficient to entail permanent limp, angularity and rotation are not rarities in surgical experiences.

Of 92 surgeons appealed to, 69 consider shortening per-

missible to the extent of one inch or more; while 19 limit the shortening to ¾ of an inch and only 4 to ½ inch.

Appreciable overriding is considered permissible by 75; not permissible by 17.

These opinions, based upon experience, indicate strongly that standards of excellence are not in accord with modern ideals.

Arbuthnot Lane says plainly, "The frequent occurrence of mechanical disability must be known to surgeons generally. . . . . It seems little short of ridiculous to read the statements of surgeons, that such condition is a rare sequence of fracture."

2. The operative correction of such conditions, after the lapse of many weeks or months, is to be regarded as one of the most difficult of all undertakings in the realm of bone surgery.

A long train of humiliating failures have attended corrective measures for the relief of unsatisfactory thigh fractures, and it is not strange that such operations are approached with hesitation or positively declined. The first requirement is a long deep incision to expose the deformity and enable the dissection to be carried entirely around it. Bone surfaces, firmly or indifferently united, are to be chiseled apart, following vaguely defined lines of cleavage. Extensive deposits of fibrous or bony material must be removed; often the latter, following the accidental distribution of shredded periosteum, reach far afield and must be torn from their lodgement along fascial planes or within muscle sheaths. The ends of fragments, having lost their original detail, are smooth and conical if not eburnated, and fixation is only possible after removal of more or less of their apices.

If many weeks or months have elapsed, muscles will have permanently contracted to a degree that will require shortening of the bone from 1½ to 2½ inches. All this is to be followed by drilling fragments and placing of one or two wires, nails, or other appliances. He is a clever operator who can complete such a task in two hours or even more. Exten-

sive unavoidable mutilation of tissues, and further dislodgement of periosteum invite infection, interrupt wound repair and, in a liberal proportion of cases, ensure disaster.

The estimate of the dangers of sepsis in fracture operations in the minds of competent surgeons is as follows: sepsis was considered as either a serious menace or prohibitive by sixty-three; as not a contraindication by twenty-nine.

That these opinions are based very largely upon the statistics of corrective, *i.e.*, late, operations, there is little doubt as less than a score of surgeons appealed to were able to report initial operations while practically all have dealt with late conditions. Only 22 out of 92 conceded the propriety of initial operations and several of these have had no personal experience along this line.

Carlton P. Flint, of New York, writes that from September, 1906, to October, 1907, he personally inspected 834 breaks at the Roosevelt Hospital. There were 53 operative cases, of which 29 were undertaken after delay for corrective purposes. In something over two hundred fracture operations sepsis was a complication in but four. He believes in early operation where the following conditions prevail, viz., all breaks either near the upper or lower ends or at the middle of shaft with great displacement or where efforts at replacement are futile.

In his excellent work on "Operative Treatment of Fractures," Arbuthnot Lane of London says, "In looking through text-books I find any number of reasons given for non-union of broken bones, the vast majority of which are, in my opinion, utterly without foundation. I have never seen one instance in which union would not have resulted if efficient operative measures had been adopted."

In *Progressive Medicine*, December, 1907, Bloodgood refers at length to fracture work as conducted in Vienna. Ranzi reports that of fifty cases operated in Von Eiselberg's Clinic only three or 6 per cent. were for fresh fracture. He emphasizes the dangers of sepsis, inclines to conservatism and contents himself with good functional results.

Bloodgood's comment is suggestive. "In my opinion the argument against immediate operation is not the risk of infection but that radical measures are not absolutely necessary."

The materials heretofore used and at the present time widely in vogue for the purposes of fixation in fracture surgery are, to my mind, manifestly open to adverse criticism. All text-books with which I am familiar suggest, for this purpose, the use of chromic gut, kangaroo tendon, wire, nails, screws, plates, ferrules, or some form of complex apparatus such as the clamp of Parkhill.

I have long since recognized serious objections to wire or any similar material, for two reasons: First, lack of stability. After a careful adjustment of wire or tendon, it will be found that the slightest movement of the distal fragment will loosen the suture to such a degree as to admit of displacement. But the more glaring, and to my mind the fatal defect of the suture lies in the difficulty of its application. After having secured approximate replacement, the fragments must be again widely separated to admit of the introduction of the suture, first through a drill hole in one fragment from without inwards; thence through the medullary canal of the second fragment to complete the loop. This entails much loss of time and an added measure of traumatism to soft parts sufficient to ensure, in many cases, complications through infection. Furthermore wire is prone to break when twisted tightly.

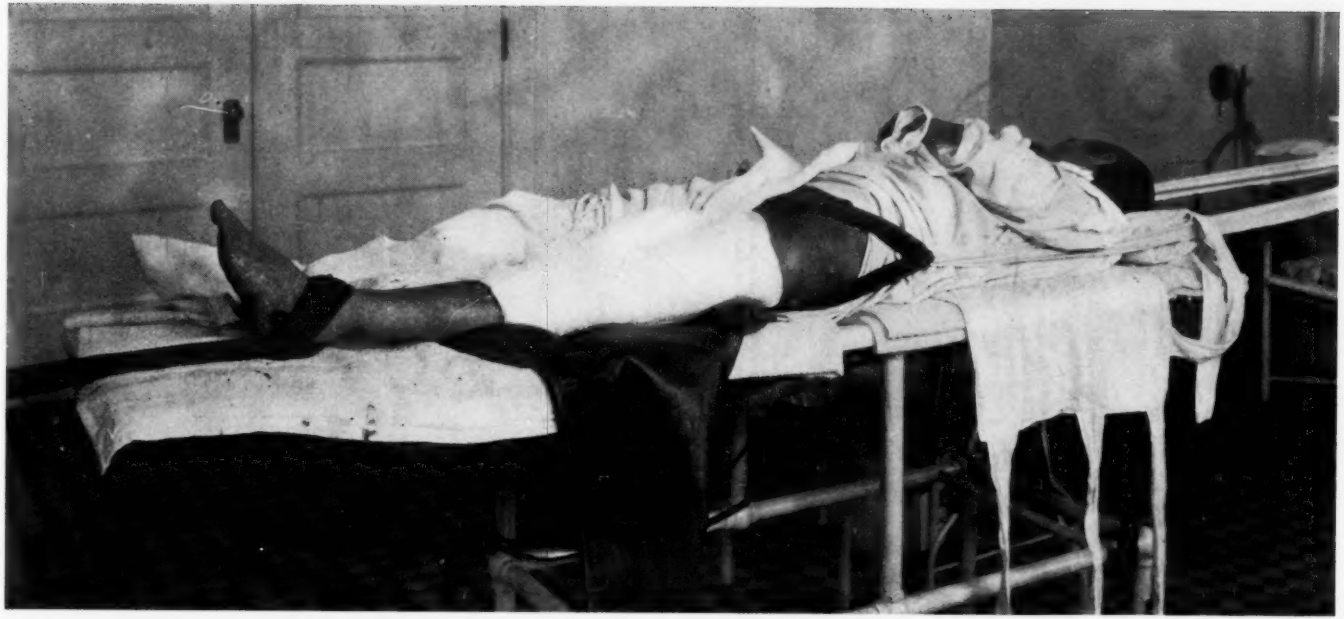
In transverse fractures the application of the screw or nail is irrational and inefficient. The appropriateness of either in oblique fractures will be shown further on. Numerous authorities, notably Edw. Martin of Philadelphia, have written enthusiastically of the value of the screw and plate. To this I raise no positive objection further than it is difficult of accurate application and entails a somewhat complex technic.

Ferrules have practically been abandoned, probably because of interference with bone nutrition at point of contact. Flint states that he has satisfactorily used a bone cylinder to be so placed within the medullary cavities of each frag-

Fig. 1.

W. ARBUTHNOT LANE'S STAPLES.

FIG. 2.



Traction apparatus for treatment of fracture of the shaft of the femur.

ment as to prevent displacement. The contrivance is certainly ingenious but when it is considered that the bone peg must be a recent specimen in order to secure ultimate absorption, that it must be of proper diameter and that its adjustment involves a complex procedure, it will probably not appeal to most surgeons.

The principle of the clamp involving protracted exposure to infection through metal cylinders, reaching from the bony fragments through the skin into the outer world, to be engaged in a horizontal bar has been elaborately set forth by Lambotte of Brussels. The apparatus, for obvious reasons, does not appeal to me. It seems to me cumbersome and awkward in the extreme and, entirely aside from the evident menace of sepsis, which I associate with it, I feel confident that the steel staple is a far simpler appliance, and will ultimately supplant it.

W. Arbuthnot Lane of London has repeatedly called attention to the value of the steel staple as a substitute for other fixation material wherever it is applicable. He employs a modification of the staple as devised by Dr. A. Jacoel. (See Fig. 1.)

Lambotte also has employed staples of slightly different type, with three or four legs which will probably be found valuable in comminuted fractures, particularly of the epiphysis.

Rixford reports employment of staples six times on five patients and Sherman four times without an infection. I have used staples in one and wire in five cases. Infection in one of the latter ended in a barely tolerable result.

In dealing with the technic of operative treatment of simple fractures of the femur, I have emphasized the necessity of simpler methods and more efficient fixation. A distinct advantage lies in making provision for systematic mechanical traction which will ensure reposition of fragments without undue violence to soft tissues after exposure of the parts.

The apparatus used at the University Hospital is illustrated in Fig. 2. Its details were worked out and exemplified by Dr. Harry M. Sherman and those who have had the oppor-

tunity of observing it in use regard it as indispensable. This is but the new application of an old principle and has possibly been used by others, though I find no allusion to it in the literature.

A skein of heavy woolen yarn is passed over each leg to serve as a medium for perineal traction. To each of these is attached a cord whose distal ends are tied to a ring in the end wall of the room. Another similar skein is applied to the ankle of the affected limb with a clove hitch. To this is attached a small set of pulleys which, in turn, are anchored to the wall at the foot of the operating table and the pulley rope is intrusted to an assistant.

Under the most careful aseptic precautions a comparatively small incision will suffice to uncover one or both ends of fragments. At this point the value of the traction apparatus is clearly apparent. The fracture being a recent one, no elaborate dissection is requisite. Having identified the line of fracture, traction by the pulley exerted upon the overlapping bones serves to bring the lower fragment slowly downward until it is capable, by external pressure upon both fragments, of being placed in exact axial relation. If the fracture be transverse or nearly so, slight relaxation of tension will serve to interlock the fragments. The operation now becomes delightfully simple. With the fragments interlocked, rotation being avoided, a drill hole is sunk in each fragment from ½ to ¾ of an inch from the fracture line, the interval being determined by the length of the staple to be introduced. The placing of the staple is materially aided by the use of an ordinary carpenter's nail set, each limb of the staple being gently driven into the corresponding drill hole. We now have the fragments firmly united in exact anatomical relation by an unyielding steel splint. If the fracture be oblique or spiral the traction principle is alike applicable. Exact reposition being thus obtained, maintenance of proper relations is secured. In these cases the staple may or may not be found available. If the conditions are such as to throw a doubt upon the efficiency of one or more staples applied at each end of the

FIG. 3.

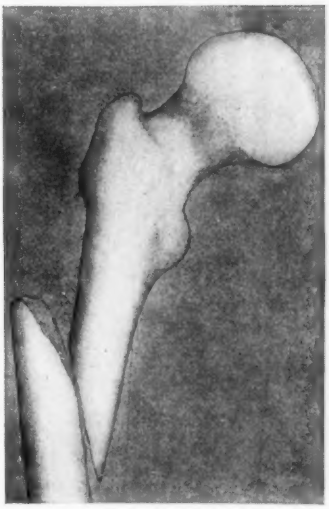
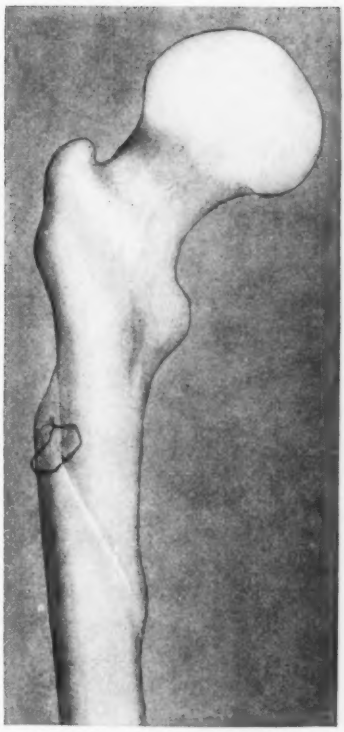


FIG. 3a.



Skiagram tracing, showing original condition and end-result after wiring.

FIG. 4.

Subtrochanteric fracture of femur with marked displacement. (Tracing from skiagraph.)

FIG. 4A.

End-result obtained by wiring in case shown in Fig. 4. (Tracing from skiagraph.)

FIG. 5.

Before operation. Lateral view. Pseudarthrosis, with crippling deformity.

FIG. 5 A.

After operation.

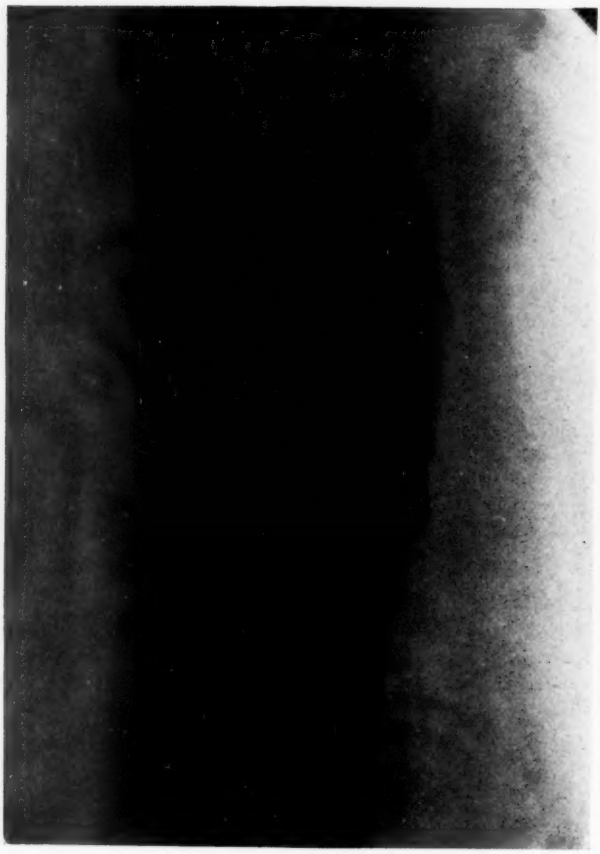
FIG. 6.

Showing end-result in a recent fracture treated with wire and staple. (Tracing from skiagraph.)

FIG. 7. FIG. 7A. FIG. 7B

Figures 7, 7A and 7B, showing original condition, status after several efforts at adjustment and end-result after application of staple, with slight lateral bowing. (Tracings from skiagraphs.)

FIG. 8



Showing end-result after use of staple in a transverse fracture.

FIG. 9.

FIG. 9A.

Figures 9 and 9A, showing overlapping associated with non-union, at the end of sixteen weeks. Good union secured in five weeks, after use of staple, without shortening. (Tracing from skiagraph.)

FIG. 10.

Showing oblique subtrochanteric fracture ten days after use of staple.

fracture line, a single steel screw of the proper length and calibre may be used as a substitute. By it the permanency of adjustment may be absolutely assured.

Closure of the wound merits a passing word. A continuous catgut suture should be applied from the deepest layer of soft tissues outward so as effectually to obliterate the dead space overlying the fracture line and staple.

Drainage, in cases where there is extensive oozing, is probably a safeguard, but in the average case I believe it is to be omitted on the ground that it affords an avenue of ingress for infection.

The wound, having been carefully protected by a gauze dressing and before pulley traction is wholly released, a plaster of Paris spica is applied from the lower leg to the waist line.

To avoid slight curvature at point of fracture as has occurred in several instances, it is best to employ permanent traction apparatus for a period of a week or ten days succeeding operation.

CONCLUSIONS.

1. The term "satisfactory result" is too elastic and does not conform to any standard.

2. The two plane radiogram when available affords the most reliable diagnosis, and determines the plan of treatment.

3. The possibility of infection is not a prohibitive menace.

4. Operative wounds are less susceptible to infection in initiative than in late corrective procedures.

5. Approximate anatomical reposition is essential to quick repair and ideal result.

6. In oblique fractures slight overriding is permissible.

7. In transverse fractures appreciable shortening is due to overlapping of fragments, and is incompatible with good surgery.

8. Mechanical traction during operation is indispensable.

9. Steel staples (or screws in oblique fractures), because of ease of adjustment and efficiency, have proven superior to other methods of fixation.

REDUCTION OF SUPRACONDYLOID FRACTURE OF HUMERUS,

(EXTENSION TYPE) BY PRELIMINARY HYPEREXTENSION OF THE FOREARM, AND MAINTENANCE OF THE REDUCTION BY EXTREME FLEXION.

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Method of Reduction.—In this connection attention is especially directed to the layer of periosteum (Case I, Fig. 1) stripped off from the posterior surface of the upper fragment for some distance above the seat of fracture, which at the same time remains attached to the posterior surface of the lower fragment, thus forming a hinge on which the latter can be swung forward and backward and turned upward and downward. This anatomical condition is pictured in Scudder's "Treatment of Fractures." It is the object of this paper to demonstrate that this periosteal attachment between the fragments is obviously the active deterring influence in the reduction of this fracture. Since the lower fragment as it swings backward on the periosteal hinge describes the arc of a circle, there must be a tendency, though slight within so small an arc, for the posterior edge of this fragment, which is the line on the latter from which the periosteal hinge takes its departure, to become raised to a higher level than it was in its normal position. With the position of the lower fragment, thus influenced by this restraint on its posterior border, it can be seen that any manipulation which tilts the anterior edge of this fragment upward, as flexion of the forearm, tends to lock the fragments together, thereby obstructing reduction, while a manipulation tilting the front of the lower fragment downward, as would be produced by hyperextension of the forearm, would throw the fractured surfaces apart at an angle which

opens anteriorly, and at the same time would relax the periosteum behind, thus unlocking the fragments and placing them in a position favorable to reduction. In this position of hyperextension the lower fragment can, with a little downward traction, be swung unobstructedly forward until the loosened periosteal layer comes again into its normal relation against the posterior surface of the upper fragment, when flexion of the forearm will tilt the anterior edge of the lower fragment upward, thereby completing the re-establishment of the normal bony relations. The test of having obtained a complete reduction of the deformity, unless interfered with by swelling, would be the ability to secure extreme flexion of the forearm.

Maintenance of Reduction.—After the fracture has been reduced the periosteum behind will prevent forward displacement of the lower fragment, while the position of extreme flexion of the forearm prevents forward riding of the upper fragment by the pressure exerted on the latter by the parts within the flexure of the elbow. Fig. 2 of Case IV shows how the coronoid process can come against the anterior margin of the upper fragment in extreme flexion and hold it in place. The proposition is herewith advanced that *extreme* flexion of the forearm is essential in order to maintain complete reduction, since otherwise pressure is not brought firmly against the front of the lower end of the upper fragment. Swelling at the outset may interfere with getting the amount of flexion necessary to maintain a complete reduction. A thin layer of absorbent cotton is placed between the skin surfaces at the flexure of the elbow to prevent irritation, besides which no constricting or compressing agent is introduced at this situation. Then the skin surface of the extremity is protected with a flannel bandage and a plaster of Paris splint is applied. The plaster bandages pass first circularly around the wrist and the upper part of the arm, encasing each singly, and then around both together down to the elbow (Case III, Fig. 3). The former turns prevent the splint from dropping off, the latter maintain the flexion. Neither flannel nor plaster

bandage should pass across the flexure of the elbow, as this would destroy the position of extreme flexion. In the literature on the subject Broca[1] commenting on the method of treating this fracture in the extended position as advocated by Berthomier[2] and by Laroyenne, states, "The fracture can with certainty be reduced by traction in the extended position with direct replacement from before backward . . . . since this completely overcomes all muscular action." Both Broca and Scudder favor treatment in the acutely flexed position. Scudder, in the legend of an X-ray plate showing the deformity of this fracture, says, "It is often impossible to reduce this fracture without incision."

Cases.—The important features are indicated in the legends of the illustrations. The first case was one with tremendous swelling. Several attempts at reduction were made before the final partial reduction was secured on the 20th day (Case I, Fig. 3). In one of these attempts, where strong traction was made with a bandage in the flexure of the joint while the forearm was forced into flexion, an evidence of the periosteal hinge being a deterrent factor to reduction was demonstrated by the X-ray of the result which showed that the lower fragment had been tilted backward and the lower end of the upper fragment was in relation with its anterior surface. Early in the history of this case the great swelling precluded the employment of acute flexion in maintaining the fragments in reduction. The other three cases were all reduced by hyperextension preceding reduction, the forearm in each case could be readily brought up into forced flexion in which position the fracture was set in plaster, and all three cases had excellent results. Case IV was the only one not set under anæsthesia.

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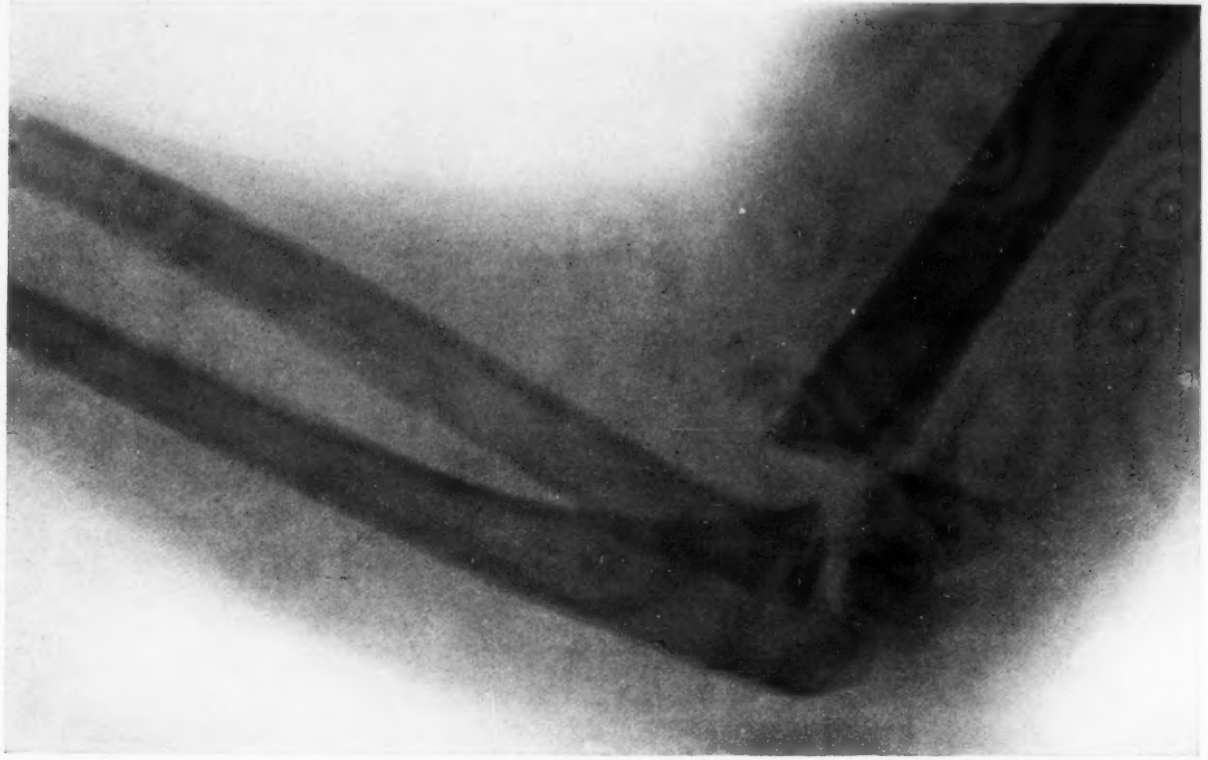
[1] Leçons Clinique de Chirurgie Infantile, p. 93.

[2] Congrès français de Chir., 1875 and 1888.

FIG. 1.



CASE I (1). Age 11. 12th day. Condition before attempted reduction. A linear shadow indicates the situation of the periosteum stripped from the posterior surface of the upper fragment for some distance above the seat of fracture, and at the same time remaining attached to the lower fragment. *The primary relaxation of this periosteal hinge by hyperextension of the forearm is essential in the reduction of this fracture.*

FIG. 2.

CASE I (2) shows result of attempted reduction 14th day, by holding the forearm at a right angle and then with downward traction on the condyles pressing backward on the upper fragment and forward on the olecranon process. *The tension of the periosteal hinge unrelaxed by this position of the forearm had held the fragments locked in the position of deformity, thereby preventing reduction by this manipulation.*

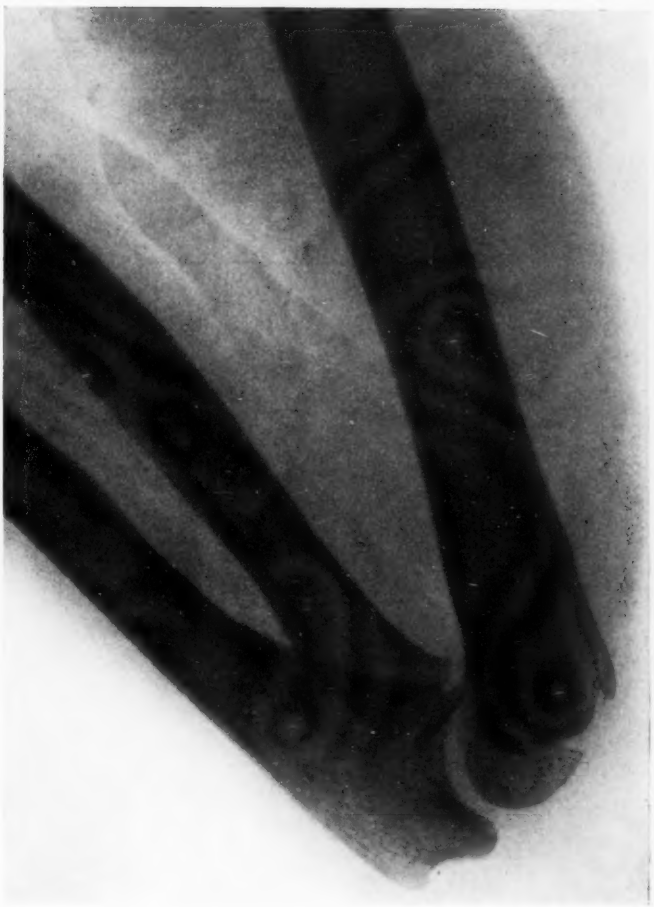
FIG. 3.

CASE 1 (3) Shows partial reduction, 20th day. With the forearm hyperextended the lower fragment was readily pressed forward and the forearm then came up into acute flexion with perfect ease. *Having previously failed to secure reduction in this case without hyperextension of the forearm, the efficacy of this method would seem to have been herewith demonstrated.* An iron spring and felt pads were relied upon chiefly to maintain the reduction, the forearm being thereby held in acute but not extreme flexion. The subsequent three cases demonstrate the possibility of maintaining a more perfect reduction simply by the position of extreme flexion.

FIG. 4.

CASE I (4) Shows result after 5½ months. Forced flexion. Acute flexion could be gained by force for about fifteen months, subsequent to which an obstructing callus developed. Forced extension would bring the forearm quite a little below a right angle.

FIG. 5.



CASE II. Age about 5. X-ray showing result 3½ months after setting by hyperextension of forearm with downward traction on condyles and forward pressure on the lower fragment and then bringing the forearm into extreme flexion. Some swelling at the time of setting. *Result:* Lacks about three degrees of full extension, otherwise perfect motion.

FIG. 6

CASE III (1). Age about 6. Original deformity.

FIG. 7.

CASE III (2). Fracture reduced by the hyperextension method, and set in plaster in the position of extreme flexion. After making three or four unsuccessful efforts at reduction, the lower fragment finally slipped forward with a little snap and the forearm came easily up into extreme flexion. *Result:* Perfect motion.

FIG. 8.

CASE III. (3) Plaster of Paris splint holding forearm in extreme flexion.

FIG. 9.

CASE IV (1) Age 60. Original deformity.

FIG. 10.

CASE IV (2). Fracture reduced by the hyperextension method, and set in plaster in the position of extreme flexion. The X-ray shows how the coronoid process in this position of the forearm, by impinging on the anterior margin of the upper fragment, can influence the maintenance of reduction. *Result:* 7 months after removal of the plaster the patient wrote that his arm was "all right."

TWENTY-FIVE HUNDRED CASES OF GAS-ETHER ANÆSTHESIA WITHOUT COMPLICATION.*

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THE recent inroads of surgery into the domain of medicine have not only largely increased the number of operations, but have introduced so many extensive proceedings requiring prolonged anæsthesia that the problem of the administration of anæsthetics has been raised from a comparatively trivial to an important position. The surgeon fully realizes that to a large degree his success depends upon his anæsthetist, that many a skilfully performed operation has been rendered useless by clumsily administered ether and that many a convalescence has been unduly prolonged by over-anæsthetizations. Still the progress of this art has not been commensurate with surgery's advance. We still see, too often, patients profoundly shocked and deeply cyanosed in the hands of inexperienced men—perhaps in those of an obliging practitioner, entirely incompetent to take this important duty upon his shoulders. To a certain extent the text-books are responsible for over-etherization. It is usual to find the statement that surgical anæsthesia requires the absence of all reflexes. This is obviously erroneous teaching and leads to gross over-use of the drug.

A glance at the records and statistics of spinal anæsthesia suffices to show that at this stage it has not approached the usefulness of general narcosis. The mortality is variously estimated at from $^1/_{10}$ to ½ per cent. Failure to produce anæsthesia occurs in 4 per cent. of cases according to Bier, 14 per cent. according to Moynihan, 10 per cent. according to

* Read before the Philadelphia Academy of Surgery, April 6, 1908.

Doderlein, etc. The after-effects are likewise more severe, 10 per cent. suffering from severe persistent headache; many have paralysis; nausea and vomiting is not infrequent. Rigidity of the muscles of the neck has been observed many times as well as untold more unusual complications.

An attempt to collect statistics as to postoperative complications and mortality from ether anæsthesia, showed a lamentable absence of records, both in the literature and hospital reports. In three of our leading hospitals no statistics whatever could be collected—in a fourth a list of 1800 cases was traced, with 18 cases of pneumonia, thirteen of which were fatal, giving a percentage of 1 per cent. of pneumonia and of .7 per cent. mortality. This is unusually high; which fact can be partly explained by the type of cases brought to this institution. As in many others, anæsthetization in *this* hospital is the duty of the junior resident, who is usually inexperienced. It is therefore a more or less fair example of statistics of etherization and its mortality in the hands of unskilled men, especially as these records do not show deaths from any of the other complications of ether anæsthesia, such as renal failure, acute cardiac dilatation, apoplexy and shock.

The present series of twenty-five hundred cases without serious complications and absolutely without pneumonia or bronchitis forms therefore a marked contrast.

A word as to what should constitute a complete surgical anæsthesia. It is that degree of sensory and motor depression required to enable the surgeon to complete his operation unhampered by movement or rigidity of the patient's muscles, and not one whit more. From this definition it obviously follows that the degree of anæsthesia varies with each operation and each individual, which fact the competent anæsthetist keeps constantly in mind. The signs and symptoms of sufficient narcosis vary likewise.

In a general way it may be said that complete surgical anæsthesia is indicated by a pupil reacting sluggishly to light, a regular noiseless breathing, a good color, muscular relaxation and absence of cutaneous reflexes. The best guide is the

pupil, but unfortunately in from 85 to 90 per cent. of cases it is not reliable during the whole time of narcosis. We find irregularity, inequality, absolute fixation of one or both pupils, etc., etc., in the above percentage of cases. This sign failing the respiration furnishes the best gauge. Close observation of the rhythm, the depth and the sound of breathing will almost invariably indicate the return of reflexes. The irritating vapor causes reflex contractions and consequently a more noisy, more hurried or more spasmodic breathing. Often the alteration is ushered in by one deep inspiration.

It is rarely necessary to carry the anæsthesia beyond a point where slight reflex inhibition of respiration is occasioned by administration of fresh ether.

To keep the patient on the borderland between consciousness and unconsciousness requires the absolute concentration of the anæsthetist. The subject's degree of narcosis varies from minute to minute. It is impossible to watch the details of the operation, or do anything but observe the changes in the patient's condition. It is much easier for the etherizer to carry the anæsthesia into the deep third stage with absolutely fixed dilated pupil, shallow respiration, cyanosis and increasing pulse rate. He then may follow the operation for minutes at a time or otherwise amuse himself, but he does so at the expense of the individual temporarily in his care. Ether is an irritant depressing poison, and each drop needlessly administered increases the danger to the patient's life, and decreases his power of resistance, so sorely needed in his period of convalescence.

In my hands the best results have been obtained by the use of nitrous oxide as a preliminary, followed by the gauze drop method. This has the following undisputed advantages: Nitrous oxide is by all means the safest anæsthetic we have, a series of 300,000 cases without a single death having been recently reported. It is not irritating and therefore greatly enhances the patient's comfort. All the choking, gagging and struggling so often seen where ether alone is used is eliminated. It greatly reduces the length of time required to

produce surgical anæsthesia, the average being from seven to eight minutes, and likewise greatly reduces the amount of ether required. This is especially true, as it is a well-known fact that it often requires as much, or more ether to anæsthetize a patient as it does to keep him under its influence for a considerable length of time. Its disadvantages are: nitrous oxide requires a more or less bulky apparatus, it is expensive, and in about 50 per cent. of cases, principally males and children, leads to an increased secretion from the respiratory mucous membrane. This last disadvantage would be an objection indeed had we no way to prevent, or at least to limit it. The most efficient preventative is the administration of a hypodermic injection of a full dose of morphine and atropine twenty minutes before the anæsthesia is commenced. This has many uses. The morphine quiets the patient, and to some extent depresses the nervous system so as to limit the amount of ether required. The atropine controls mucus secretion. Preliminary sprays of adrenalin and cocaine solution are also of some use. A thorough spraying of the mucous membrane of the nose and throat furthermore eliminates the rare danger of reflex cardiac inhibition occasionally observed as the result of the first administration of ether. If mucus is secreted in excess, notwithstanding these preliminary precautions, great care is necessary. Under no circumstances should such a patient be deeply anæsthetized—never to the point where inhaled mucus ceases to cause a reflex cough. The common practice of swabbing out the mouth and throat by gauze or other sponges is worse than useless; mucus reappears in less than two minutes and the friction of the sponges increases the flow. Raising the patient's shoulders allowing the head to extend fully while placed on its side allowing the mucus to flow into the cavity of the cheek thence leak out at the angle of the mouth, is the best treatment for this condition. Occasionally repeated sprayings and another dose of atropine helps to control the ceaseless flow.

As to the administration of ether itself the open method, and the most open one, namely, gauze, was invariably used.

Pads about four by five inches and about eight layers in thickness form the most convenient method of administering the drug. The concentration of the vapor may be regulated by the number of layers of gauze employed. Sixteen is about the average number, children requiring less, women less than men, the latter frequently calling for twenty-four layers. If great concentration is required the ether may be dropped upon the under gauze and then covered by an overlaying pad, which will practically exclude the air. More ether is required by the gauze than by any other method, the average amount for men being seven to eight ounces for the first hour, five or six for women. After this time the amount is greatly reduced, especially if a morphine preliminary has been employed, it not being an unusual occurrence to have thirty minutes elapse without the necessity for more vapor. Average amounts of ether required per hour are of no value statistically inasmuch as they vary so greatly with the individual.

If the anæsthetist observes the precautions cited above he will be enabled to carry on his narcosis without endangering the patient's life from over-etherization, which may lead to shock, inhalation pneumonia, kidney complications and great physical depression, reducing vital resistance and healing powers during convalescence.

The management of a so-called difficult case often taxes the ingenuity of the most experienced. Every one knows that notwithstanding the greatest care and knowledge it is sometimes impossible to completely relax some individuals. The type occasioning these difficulties is usually the fat, flabby, plethoric, short-necked male, addicted to the use of alcohol, whose mucous membranes are in a constant state of congestion, and whose arteries are sclerotic. This class of patients run great danger from complete ether narcosis. Their resistance is low, hence pneumonia is more likely to follow inhalation of infected mucus, almost always profuse in these cases. Their arteries are brittle, hence subject to apoplectic rupture, caused by the cyanosis so often the result of the early administration of ether. Their kidneys are, as a rule, impaired

and therefore likely to suffer from the anæsthetic, best results in these cases were attained from the following precautions: Twenty minutes before the anæsthesia a very full dose of morphine and atropine is injected hypodermically, the chest is covered by a cotton pneumonia jacket. Immediately before administration of ether, the mouth, nose and throat is thoroughly sprayed with a 2 per cent. eucaine solution. Then a mouth-gag of the Whitehead type is inserted and the preliminary nitrous oxide commenced. When the patient is unconscious, ether is substituted in moderate concentration,—about sixteen layers of gauze moistened with ether being sufficient. At this stage frequently the patient spasmodically and reflexly fixes the jaws defying all attempts to open them, respiration ceases leading to profound cyanosis and the increased blood pressure dependent thereupon, which in turn may cause the rupture of sclerotic vessels. Atropine and morphine will decrease this tendency, but not eliminate it. The presence of the previously inserted mouth-gag saves the situation inasmuch as it is easy to open the jaws, pull the tongue forward, open the larynx and relieve the cyanosis.

If after ten minutes of administration of ether the patient shows no sign of relaxation I change off to chloroform through an Esmarch inhaler, unless contraindicated by the cardiac condition. By observing these precautions it is usually possible to handle these cases in the safest and most satisfactory manner.

A word as to the after-effects of ether anæsthesia: Nausea and vomiting are perhaps the most constant. This annoying, and at times dangerous complication, is greatly reduced by the gas-ether method. In a recent series of one hundred cases anæsthetized by this method by students under my instruction the following results were obtained; persistent vomiting (48 hours) in one case, a gall-bladder operation, the condition being ascribed to a low degree of acute gastric dilatation, 81 per cent. did not vomit at all after regaining consciousness, the remaining 19 per cent. had varying amounts of gastric distress during the first twelve hours, in a few

continuing during the first twenty-four hours. The use of oxygen and inhalation of vaporized vinegar have been given up after a thorough trial. If the patient be not over-anæsthetized oxygen is not needed, because there is no cyanosis, and the patient will regain consciousness within ten minutes after the last suture is placed, often moving and talking at random immediately after completion of the operation. The administration of oxygen did not seem to improve upon the statistics given above. A similar conclusion was reached after the use of vinegar.

Ether burns of the face never occur when the gauze drop method is adhered to. If the ether be spread over a sufficiently large evaporating surface and not allowed to drop in one place it will be found that the under surface of the gauze pad is entirely dry. In no case has an ether burn resulted in this series, nor in any of the cases anæsthetized by students.

The advantages of this method are: Its relative safety, comfort to the patient, the time and ether saved in anæsthetization, freedom from complications, such as bronchitis, pneumonia, annoying nausea and vomiting, shock and reduced vital resistance.

In conclusion I would make a plea for less profound anæsthesia in all cases, for rules preventing the junior resident from giving anæsthesia, unaided, and for the more extensive instruction of this art in our medical schools, in the light of its daily increasing importance.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting Held April 8, 1908.

The President, Dr. Joseph A. Blake, in the Chair.

STRANGULATED FEMORAL HERNIA; RESECTION OF INTESTINE.

Dr. Irving S. Haynes presented a woman of 40, who was admitted to the hospital on March 3, 1908. She had had eight full-term pregnancies and one miscarriage. About nine years ago she had had an attack of pain for a few hours in the lower part of the abdomen, more pronounced on the right side, and extending up toward the epigastrium. A second similar attack was felt some years later.

Her present attack, which began 25 hours prior to her admission to the hospital, came on suddenly with vomiting and pain in the right lower quadrant of the abdomen. The bowels were constipated. Her pulse on admission was 84; temperature, 99.4. Her condition was apparently so favorable that Dr. Haynes said he was not informed of her admission, and he did not see her until the following morning. Her pulse at that time was 72; temperature, 98.6. She complained of cramp-like pains in the epigastrium, and at long intervals raised some gas. She had on three or four occasions vomited a greenish fluid; her bowels had not moved.

Examination showed a small, hard, slightly sensitive femoral hernia, as large as an English walnut. An immediate operation was done, and through a two and a half inch incision a black loop of intestine was disclosed, three inches in length. There was no omentum in the sac. The constriction at Gimbernat's ligament was freely divided, and hot applications used for a quarter of an

hour. As the intestine remained black and lustreless, it was resected and an end-to-end anastomosis made with a double row of stitches. Three kangaroo tendon sutures were used to unite Poupart's ligament to the pectineal fascia and ligament. The bowels were opened on the second day by an ox-gall enema. The patient was out of bed on the twelfth day, and left the hospital on March 24.

PROLAPSE OF RECTUM; BLOODLESS RESECTION.

Dr. Irving S. Haynes presented an Italian boy, ten years old, who was operated on March 19, 1908, for a prolapse of the rectum which had existed for seven years. At each defecation, about an inch of the rectum protruded. There was slight bleeding. The prolapse could be easily replaced and caused him no pain. The bowels were regular, and there was no history of constipation.

Upon examination, the sphincter was found relaxed, and the anus dilated and patulous. There was a superficial fissure in the anterior border of the anus; no ulceration of the mucous membrane. The rectum was cleansed and packed. The prolapsed section of the bowel was easily drawn outside of the anus for a distance of about three inches, and its base, half an inch from the anus, was ligated by overlapping but not interlocking ligatures passed by a round needle. For this purpose, No. 2 ten-day chromic gut was employed. The distal portion of the prolapse was excised to within a quarter of an inch of the ligature lines, and the cut edges whipped over with a button-hole stitch of Pagenstecher thread. On withdrawing the rectal tampon, the suture line immediately retracted above the anus.

A plug of gauze, three-quarters of an inch in diameter, with a quarter-inch rubber tube for a core, and covered externally by rubber tissue was fastened in place, and extended a short distance above the line of resection.

The boy made no complaint of pain or discomfort after the operation. His bowels moved spontaneously on the fourth day and expelled the plug, which was not replaced. At no time was there any bleeding. When he left the hospital, on March 27, there was a slight induration along the line of resection, but no contraction whatever. As to size, the rectum seemed perfectly normal.

PARTIAL GASTRECTOMY FOR UNUSUALLY SITUATED CANCER, WITHOUT OBSTRUCTION.

DR. GEORGE WOOLSEY presented a man, 66 years old, who was admitted to Bellevue Hospital on February 6, 1908. There was no history of pain after eating until two years ago when he began to complain of pain commencing about one hour after the ingestion of food. For the past year this pain had been constant, sharp and stabbing in character, and worse after eating. The appetite had not been lost. He had only vomited once or twice and there was no history of hæmatemesis. The patient had lost about 50 pounds in weight during the past two years.

Upon examination, the patient was found to be much emaciated, with a pale, yellowish complexion. His arteries were thickened; the pulse weak and intermittent. There was a systolic murmur near the episternal notch. The abdomen showed a smooth mass, about the size of an adult fist, to the right and a little above the umbilicus. It was slightly movable in all directions, and moved somewhat with respiration. It was tender on pressure, and tympanitic on percussion. An examination of the urine showed albumin, but was otherwise negative. The blood contained 45 per cent. of hæmoglobin, with 15,000 white cells.

Operation, February 13, 1908. A vertical incision was made over the mass, which was found to be adherent to the parietal peritoneum. Upon freeing these adhesions the mass slipped upward and toward the median line, and on extending the incision upward it was found to be a tumor of the pyloric end of the stomach and to be further adherent to the transverse colon. These were separated, and the mass was removed after closing the duodenum with three rows of sutures. A posterior gastro-enterostomy was then done with the Murphy button.

Five days after the operation bile and duodenal contents began to escape through the wound. In spite of that fact, the remaining fistula gradually closed spontaneously, and it was now absolutely closed. The Murphy button was passed on the twenty-first day. The tumor was pronounced by the pathologist to be a carcinoma of the pyloric end of the stomach which had formed on the base of an old ulcer.

He has gained much in weight, color and general condition. There were few or no lymph-nodes enlarged.

URETERAL CALCULUS (TWO CASES); IMPROVED METHOD OF APPROACH.

Dr. Charles L. Gibson presented two cases to demonstrate an improved method of approach for calculi situated in the lower portion of the ureter.

The first patient was a man 62 years old whose symptoms dated back ten years. A calculus, weighing 270 grains, and located just at the brim of the pelvis was removed, and the ureter sutured in two layers. The wound was closed without drainage and healed by primary union within two weeks. Time of operation, 35 minutes.

The second patient was a man, 32 years old, whose symptoms dated back five years. A calculus, the size of a flageolet bean, was removed from the ureter. The ureter was sutured in two layers, and the wound closed without drainage. The patient was in bed ten days and left the hospital on the twelfth day after the operation.

The incision employed in both of these cases, Dr. Gibson said, was planned to give a maximum amount of room and exposure of the lesser pelvis, entirely extraperitoneal, and to damage as little as possible the muscular layers, and to be made in intersecting planes. The superficial portion of the incision was practically the same as that devised by Stimson and Pfannenstiel, *e.g.*, an incision was made through the skin, aponeurosis of the external oblique, partly through the aponeurosis of the internal oblique and partly across its muscular layer, beginning at the mid-line, a finger's breadth above the pubis, carried parallel to Poupart's ligament, and then vertically upward to or even beyond the anterior superior spine. The upper flap was then retracted well upward. The fascia of the transversalis was then divided just as it emerged from under the rectus, and parallel to it. With the patient in the Trendelenburg position the peritoneum was easily pushed upward, and the rectus muscle, which was much mobilized by the preceding incisions, was retracted well away. The room and view obtained by this method allowed of further extrapelvic manipulations being carried out with the greatest ease. In both cases the ureter was readily freed from its bed, and lifted on the finger to the level of the skin wound, permitting of its incision and careful suture with absolute precision.

Dr. Samuel Alexander said he had been present at both the operations reported by Dr. Gibson, and could testify to what had been said regarding the method of approaching the ureter that had been described. The incision gave one control of the ureter throughout its entire length, especially its lower portion. The operation was comparatively bloodless, and the only difficult feature of it was the securing of the ureter in place in order to open it. This was overcome by passing a retractor underneath the ureter, drawing it into view, and then it could be manipulated with great ease. The speaker said he considered the operation described by Dr. Gibson as a distinct and valuable advance in the field of ureteral surgery.

EXCISION OF KNEE.

Dr. Royal Whitman presented a woman, 21 years old, who for a period of about six years had suffered from a rather severe form of tuberculosis of one knee-joint. She entered the Hospital for Ruptured and Crippled in December, 1907, where the knee was resected by Dr. Whitman. Three months after the operation the woman was able to resume her occupation as cook.

The removal of necrosed tissue from the tibia left two rather large excavations which had not in any way interfered with solid union.

OPERATIVE TREATMENT OF COXA VARA.

Dr. Royal Whitman presented a boy, 10 years old, who was operated on in August, 1907, for coxa vara of five years' duration. To remedy the condition, Dr. Whitman did the following operation, which he had now employed in these cases for many years: A wedge of bone was removed from the base of the trochanter, with its apex directly facing the trochanter minor. The size of the wedge to be removed could be accurately determined by means of an X-ray picture. The bone was not absolutely divided as the cartilaginous trochanter minor remained, and there was therefore no danger of the fragments overlapping. The wedge was closed by gently abducting the limb, the neck being fixed by contact with the upper border of the acetabulum, and in this position of abduction a plaster spica bandage was applied which remained until union had taken place.

By this method, Dr. Whitman said, the full range of abduction was restored and functional cure was assured.

FRACTURE OF THE NECK OF THE FEMUR.

Dr. Royal Whitman presented a man, about 40 years of age, who four months ago fell, sustaining an injury to the right hip. He was taken to a hospital, and after remaining there for a few days, was sent home. He suffered a good deal of pain in the region of the injured hip, and after a few weeks applied for treatment at another hospital, where a spica bandage was applied with the limb in the line of the body.

Four months had now elapsed since the accident. Examination showed that although union of the fracture had apparently occurred, yet the limb was adducted and flexed. In this case, Dr. Whitman said, the deformity should have been reduced at once under an anæsthetic, the limb put up in full abduction and fixed by a plaster spica bandage. In that event a functional cure might have been anticipated in place of the disability illustrated by the patient which could be remedied only by operation.

FRACTURE OF THE PELVIS; RUPTURE AND LACERATION OF THE URETHRA.

Dr. Samuel Alexander presented a man, 21 years old, who was admitted to Bellevue Hospital on March 4, 1908. On the evening of his admission a heavily laden wagon which he was driving was overturned and he fell under one of the wheels, which struck him upon the outer rim of the ilium and rested upon him, pinning him to the ground. He was not extricated until the wagon was lifted and he was then brought to the hospital by ambulance. He was at first admitted to the general surgical service, and examined by the house surgeon, who failed to recognize the nature of his injury. On the following morning it was found that he had retention of urine. An attempt was made to pass a catheter, and two or three ounces of blood was drawn, the catheter not entering the bladder. He was then transferred to Dr. Alexander's service.

Upon examination, the patient lay in the prone dorsal position, with the left hip flexed. Any attempt to move the hip caused great pain in the left groin. There was some ecchymosis over the crest of the ilium, and marked ecchymosis in the perineum, but no swelling.

By rectal examination a fracture of the left pelvic ramus was discovered. The fracture was oblique, and the outer frag-

ment was displaced downwards. The abdomen was tympanitic, but there was no tenderness, and no signs of extravasation of urine.

A silk coudé catheter, No. 16 F, passed without much difficulty into the bladder; the urine drawn was perfectly clear.

Operation.—A perineal section was made, using the catheter as a guide. Upon introducing the finger, after opening the membranous urethra, the sharp end of the outer fragment of bone could be felt on the right side of the urethra. The latter had been cut through, and the wall, especially upon the left side, was lacerated. The upper end of the divided urethra had retracted for about ½ inch.

A metal perineal tube was put in place, the fracture was reduced, and the opening over the bone was plugged by a strip of iodoform gauze. The pelvis was strapped anteriorly with broad strips of adhesive plaster.

The patient was put in bed with shoulders slightly raised, and a circular rubber cushion under the buttock. Syphon drainage was established.

The tube and packing remained in place continuously and without interruption of the drainage for 8 days. The patient was kept in bed for four weeks. The perineal wound healed kindly, and with no complications. The bowels were moved by enema, and each movement was supervised to prevent soiling of the wound. At the end of four weeks dilatation of the urethra was begun by sounds. The patient was now well; the urethra admits No. 26 F without difficulty and urine was voided normally and in a good stream.

ENCYSTED HYDROCELE OF THE CORD (INGUINAL PORTION), RESEMBLING OMENTAL HERNIA.

Dr. Samuel Alexander presented a man, 20 years old, who was admitted to Bellevue Hospital on February 10, 1908, for a swelling in the right inguinal region. About one year ago the patient noticed a lump in the right groin which he says was about the size of an English walnut. He thought that at first this could be reduced by pressure, but for several months it has been impossible to reduce it, and he thinks that it is growing larger. Two weeks before admission he began to have sudden sharp shooting pains, especially at night after work. The swelling is painful when he coughs.

Upon examination, there is an oval tumor about the size of a small egg. This is adherent to the cord, and is situated within the inguinal canal. The swelling is tense and painless. Upon coughing there is slight impulse to the hand placed over the tumor, but no impulse to the finger passed through the external ring.

Diagnosis made of an encysted hydrocele of the cord. Operation, February 12, 1908. The inguinal canal opened as in Bassini's operation.

The tumor did not communicate with the abdominal cavity. There was no hernia. The tumor consisted of a sac lined with serous membrane, with a long diverticulum extending upward. The wall of the sac was thickened. It contained six drachms of clear hydrocele fluid.

The wound healed *per primam* and the patient was discharged March 3.

EPITHELIOMA OF PENIS; PARTIAL AMPUTATION OF PENIS AND LYMPH-NODES.

Dr. Samuel Alexander presented a man, 54 years of age, who was admitted to Bellevue Hospital December 5, 1907. He denied any venereal disease, but had been operated upon for an abscess in the groin twelve years ago. During November, 1906, he noticed a small nodule upon the glans penis, slightly ulcerated. He went to a dispensary, where a diagnosis of syphilitic chancre was made, and he was treated by injections of the salicylate of mercury. This treatment was continued for several months without causing any improvement. The growth has never been painful. There is no family history of cancer.

Upon examination, a nodule, slightly ulcerated and fungating at the edges was found upon the glans penis; the nodule was hard, and involved about one-half the entire thickness of the glans.

A section of this nodule was removed and examined by Dr. Ewing, of the Cornell University Medical College, who pronounced it an "epithelioma, the growth of which seemed to be slow." The inguinal lymph-nodes were enlarged and hard.

Operation, December 11. About one-half the penis was removed by a circular amputation, the urethra being cut ¾ inch longer than the stump. The floor of this part of the urethra was split longitudinally, and the edges united to the skin and the sheath of the corpora cavernosa by sutures; the edges of the

skin were likewise sutured to the outer sheath of the corpora. The inguinal lymph-nodes were removed *en masse* from both sides. The patient was regularly catheterized for three days.

On January 21 the patient had a chill and rise in temperature to 104°, and developed erysipelas in the left inguinal wound, which had nearly healed. This delayed his convalescence and necessitated an incision of the left thigh. He did not leave the hospital until February 20.

A pathological examination of the inguinal glands showed no evidence of metastasis.

EPITHELIOMA OF PENIS; COMPLETE AMPUTATION OF EXTERNAL GENITALS AND INGUINAL LYMPH-NODES.

DR. SAMUEL ALEXANDER presented a man, 47 years old, who was admitted to Bellevue Hospital February 25, 1908. He denied all history of venereal disease. No family history of cancer. Six months before admission to the hospital he fell, striking the penis and scrotum upon a beam. No pain or swelling nor urinary disability followed. He had a congenital phimosis, and had never been able to retract the prepuce. Four months before admission he noticed a swelling in the right groin which was painful, but this partly subsided. Two months later the swelling recurred, and about the same time his penis began to swell and there was a discharge from within the cavity of the prepuce. He then began to have difficulty in urination, owing to obstruction at the meatus. The penis and the swelling in the inguinal region continued to enlarge, and the obstruction to urination became more marked. Upon examination, the penis was found greatly enlarged, measuring 3 inches in circumference; it was distorted, being curved upon itself to the right side. There was a profuse discharge of thin pus from the prepuce. The entire glans penis and the inner side of the prepuce were fungoid in appearance; the external meatus was reduced to the size of a fine needle.

The inguinal glands were enlarged upon both sides; the skin was reddened over these regions, and there was deep fluctuation upon the right side.

On February 27 a part of the prepuce and of the growth was removed for pathological examination, and was pronounced by Dr. Norris, pathologist to Bellevue Hospital, to be a very rapidly growing epithelioma.

On March 4, the inguinal nodes upon both sides were removed, and a complete amputation of the external genitals was performed, the urethra being transplanted to the perineum. The lymph-nodes were found diseased, and there were numerous metastatic deposits upon both sides. The wounds in the groin were left open; the remaining wound was sutured. The latter healed primarily, and the patient was discharged April 8. He passes a full stream of urine through the urethra, and has gained greatly in general health since the operation.

DR. CHARLES L. GIBSON said the question of the time of operation was very important in connection with cancer of the penis. The speaker said he could recall patients who were alive and free from signs of recurrence ten years after operation. He did not believe that removal of the inguinal glands added much to the security of these cases, because there was just as much chance that the deep-seated glands were involved. The secret of success in dealing with malignant disease in this location, as elsewhere, was to get hold of the cases early.

DR. ALEXANDER, in reply to a question, said the removal of the testes in these cases added much to the convenience of the patient. If they were permitted to remain, they interfered with urination. In some cases where he left the testes, he had split the scrotum in the median line, and then sewn up the incisions, thus making two complete sacs, which could be separated during the act of urination. It was usually preferable, however, to do a complete castration.

In early cases, where a partial amputation sufficed, it was not a good plan to take out the inguinal glands unless they were involved. He recalled one case where the operation was done nine years ago, without removing the inguinal glands, and the patient was still alive and well. In another case the recurrence was in the perineum, and not in the inguinal glands.

OPERATION FOR OLD INJURY OF THE FOREARM, INVOLVING THE FLEXOR TENDONS, MEDIAN AND ULNAR NERVES.

DR. WILLIAM A. DOWNES presented a man, 19 years old, who sustained an injury to the forearm 4 years ago, involving the flexor muscles and both nerves. As a result of this, the fingers of the right hand became absolutely fixed in a position of extreme flexion and the seat of trophic ulcers.

The patient was admitted to the General Memorial Hospital eighteen months ago, and the flexor muscles were exposed through an incision extending from the elbow to the wrist. This showed that these muscles in the middle third were represented by a cicatricial scar, no muscular tissue whatsoever remaining. The ulnar and median nerves were exposed, their upper and lower ends, which were separated in both cases over 2 inches, united by plastic operation, and the flexor tendons were lengthened by a tendon-splitting operation. The tendons were then wrapped in Cargyle membrane to prevent the formation of adhesions. There were evidences of some regeneration of the nerves since the operation and flexion had been gained to about one-half normal. The case was shown as evidence that much good could be accomplished in these cases of long standing contracture following trauma.

VOLKMANN'S ISCHÆMIC PARALYSIS.

Dr. Alfred S. Taylor read a paper with the above title, for which see page 394. In connection with his paper, Dr. Taylor showed a case illustrating the condition described.

Dr. John F. Erdmann said that about two months ago he saw a case of this form of paralysis in a seventeen-year-old boy who came here from the South. He had sustained a fracture of both bones of the left forearm several months before, and this had resulted in ischæmic paralysis, with trophic changes in the area of the median nerve, with ulceration of the fingers at the terminal phalanges in the area supplied by the median, and profound trophic changes of the nails. He gave a history of tight bandaging with wooden splints for a period of seven days following the accident. Electrical examination made by Dr. Joseph Collins showed that the paralysis of the nerve was complete. An incision was made down the middle portion of the forearm, exposing a marked muscle and fascia infiltration. The median nerve was exposed, and about its middle portion in the forearm a constriction was found, due to the imbedding of the nerve in this infiltrate. This constriction was about two inches long, and the nerve was diminished fully one-half its size above and below the point of constriction. The interosseous nerve was also exposed and found to be compressed. In spite of the fact that a very light dressing was applied after the operation the tissues

rapidly became blue-black and cold. It was necessary to simply lay the forearm in a trough splint, without exercising any pressure whatever. Subsequent to the operation, the patient being under observation for three weeks only, a marked improvement was observed, the ulceration of the fingers and nails rapidly healed, and the color and vascular supply and the local temperature were very much improved. A certain degree of extension had been gained. A report by letter to-day shows that the patient has been considerably improved, but that union of his fracture had not yet taken place. No excision of bone, with a view of shortening the forearm and thereby lengthening the tendons, was done.

Dr. Joseph A. Blake said he did not think this condition of ischæmic paralysis was so very uncommon. He could recall three such cases, one of them very recent. In one case, where he cut down upon the nerves, he found a condition of fatty degeneration of the muscles, which had not yet reached the fibrous stage. In the case he saw recently, the deformity and contraction were characteristic. Before considering shortening the bone in these cases, Dr. Blake said, he would suggest the use of massage, electricity and passive motion for a considerable period in order that the ultimate amount of contraction would be reached, thus obviating a relapse.

Dr. Taylor, in closing, said that in recent cases, like the one mentioned by Dr. Blake, where no nerve changes had occurred, experience had shown that conservative treatment in the way of passive motion, massage and electricity accomplished practically nothing. In these cases, a Frenchman named Martin had recently suggested the use of a splint attached to the fingers by means of rubber bands, so that constant and moderate extension could be thus exerted. Two weeks ago, at a meeting of the Pediatric Section of the Academy of Medicine, Dr. Reginald H. Sayre showed a case of this kind in which he had used an orthopædic splint, by means of which the degree of extension could be regulated and gradually increased. In that case and also in Martin's the contracture appeared after seven weeks, so that both were probably comparatively mild cases with only partial cicatrization of the muscles. In both cases there was very marked improvement. This treatment gives no relief to damaged nerves.

Stated Meeting, April 22, 1908

The President, Dr. Joseph A. Blake, in the Chair.

RESECTION OF TUBERCULOUS ELBOW.

Dr. John A. Hartwell presented a bricklayer, 53 years old, who was admitted to Lincoln Hospital on March 9, 1905. In April, 1904, he first began to suffer from evidence of a tuberculous infection in the left elbow-joint. He paid no attention to this, and continued to work almost uninterruptedly for 11 months. He then applied for admission at the hospital. Examination showed a typical advanced condition of tuberculosis of all of the structures composing the elbow-joint. There were discharging sinuses leading into it which had opened spontaneously. The muscles of the forearm were infiltrated with tubercular material as far as the middle third. Operation was performed a few days later, a typical resection of the joint being done through an externodorsal incision. All the joint structures were removed, the humerus being sawed through at the epicondylar level, the ulna just below the coronoid, and the radius through its neck. This was done subperiosteally in each case, the expansion of the triceps and the insertion of the biceps being carefully preserved, as well as the origin of the muscles arising from the condyles The tubercular sinuses in the forearm were thoroughly opened and scraped. A dressing of iodoform paraffin plug was used, and the arm put up in the extended position. Convalescence was very slow, numerous tubercular abscesses having to be opened. The joint was moved from one position to another, so as to allow the best possible drainage, at the same time endeavoring to keep the bones in close apposition. Complete healing of the sinuses did not take place for more than a year. During the past two years the patient has had increased power and usefulness in the limb, and he has gained about 30 pounds in weight. Examination and X-ray (Fig. 1) at the present time show that there is no apparent true joint formation, the condition being a mild degree of flail-joint. He has, however, considerable power, both in flexion and extension; he has absolutely no pain in the joint, and is able to use it for light work. A flexion splint has been worn part of the time to prevent lateral movements, but he seems to have more comfort without it. The case is shown as one of a very

FIG. 1.

Condition of elbow joint four years after resection for tuberculous.

fair functional result, in spite of the loss of a considerable amount of the bony structures, and the very advanced involvement of the soft tissues at the time of operation. The functional value of the muscles arising above the external condyle is well preserved, and these serve a much useful purpose in the movements he enjoys. His general health at the time of operating and the local disease were of such a nature that amputation was seriously considered, and the convalescence was so slow that subsequently it presented itself as the only means of cure.

DR. WILLY MEYER said that the Kocher incision gave very free access to the elbow joint, and the final functional result of this method of resection, on account of the preservation of the triceps tendon and part of the olecranon, was usually excellent. Dr. Meyer said he was strongly in favor of doing these operations without the use of the Esmarch bandage, and he recalled two instances where paralysis lasting several months and seriously interfering with the after-treatment followed the application of the bandage. In tuberculous cases where sinuses persisted, he thought the hyperæmic treatment would prove very serviceable.

OLD FRACTURE OF PATELLA: LENGTHENING OF QUADRICEPS.

DR. HARTWELL presented a negro, 42 years old, a truckman, who was admitted to the Lincoln Hospital on February 5, 1908. The history he gave was that about two months previously he had fallen from a truck, striking against the street curbing, and receiving, probably by direct violence, a fracture of the left patella. Excepting for a bandage about the knee, he received no treatment whatever. He remained in bed for a time, and then resumed his work as a truckman. He was able to walk on a level surface with very little trouble, but was unable to go up stairs or extend his knee when any weight was upon it. He is unable to raise his heel from the bed when lying in a dorsal position.

There is a transverse fracture of the patella, with a separation of 3½ inches between the fragments, which can be reduced to about 3 inches by firm traction. There is considerable outgrowth about the fragments, so that each fragment measures approximately 2 inches in its vertical diameter, the right patella having a vertical diameter of 3 inches.

Operation was performed on February 8, 1908, as follows:

The patient was placed in a dorsal position, and a vertical incision about 6 inches long was made over the fragments, exposing the muscle and tendon above. The fibrous union between the fragments, which was very much stretched and thin, was cut away, and the joint exposed and irrigated. The aponeurosis on each side was stretched, but as it contained very heavy fibrous bands, it was cut, and about 1 inch resected on each side of the patella. The fragments were now 3½ inches apart, but could be forcibly reduced to 1¼ inch. A thin layer was sawed from the fractured borders of the patella to procure fresh surfaces for apposition. An M-shaped incision was then made into the quadriceps tendon and muscles, the outer legs beginning on the two borders of the tendon and running upward and inward toward the midline; the inner legs running from these and converging to a point directly above the patella, and about 1 inch from it (length of each leg about 3 inches), and carried to a depth of about two-thirds of the thickness of the muscle and tendon. Traction now brought the fractured edges of the patella into good apposition, with a comparatively small amount of tension. Two holes were now drilled into each fragment, and a square suture of very heavy silver wire put in and twisted on the anterior surface of the upper fragment. The aponeurosis just outside of the patella was overlapped and sutured with three stitches of heavy kangaroo tendon, thus bringing the fragments in perfect apposition. The remaining parts of the aponeurosis were overlapped and sutured with chromic gut No. 2, doubled. The apices of the incision in the tendon were united with the apices of the muscle, thus lengthening the vasti about 2 inches, and the parts sewed together with chromic gut No. 2, doubled. A counter opening was then made well back on the outer surface of the knee-joint, through which a large cigarette drain was passed. The skin was sutured with silk, and a sterile dressing applied, with a circular plaster splint encasing the whole of the lower extremity, with a window cut exposing the original incision and drainage wound. A small rubber tissue drain was placed in the lower angle of the skin incision. The patient was returned to the ward in good condition.

The wound healed *per primam* excepting at the exit of the drain, which healed in the course of ten days by granulation. There was no rise of temperature at any time. On the second day the patient got out of bed and walked to the bathroom,

FIG. 2.

Old widely separated fracture of the patella after tendon-lengthing and wire suture.

without apparent harm. With this exception he was kept in bed for five weeks. The first dressing was done on the fifth day, and the drains removed. On the tenth day slight passive movements of the patella were begun, the two fragments being firmly grasped and moved together. This was repeated each day for about three weeks, the amount of motion being increased gradually. After about five weeks the patient was encouraged to lightly contract the quadriceps muscle, so as to exert traction on the patella, the extremity still being encased in plaster. The splint was left off at night in the sixth week, and passive and active motion gradually begun. At the end of seven weeks the patient began to walk without a splint, but was cautioned against throwing any weight on the knee in a flexed position. At the present time (ten weeks after operation), he has a range of motion of about 45 degrees, both passively and actively. He walks without a limp, but complains of pain on long standing. This is probably due to the pressure of the wire suture against the condyles, and it may be that a subsequent operation may be necessary for the removal of the wire. Palpation of the patella shows strong fibrous union between the fragments, with no apparent separation on flexion of the joint. The X-ray plates, however (Fig. 2), show that there is a tendency to such separation, and that the wire suture is probably still bearing a considerable strain, though there is no evidence that it has cut through the patella to any extent. The quadriceps tendon and muscles, apparently, are functionating normally.

BILATERAL NEPHROTOMY FOR NEPHROLITHIASIS.

Dr. John A. Hartwell presented a man, 46 years old, a clerk, who was admitted to Lincoln Hospital on January 30, 1907. He had an attack of gonorrhœa 20 years ago, without sequelæ. Otherwise, aside from his present history, he had always enjoyed good health. In 1905 he had an attack which suggested a left renal calculus. After that he was operated on at a hospital in another city a left nephropexy being done, apparently under the belief that his trouble was a movable kidney, with a Dietl's crisis. He had no further attack on the left side. About ten days prior to admission to Lincoln Hospital he received a blow from a blunt object over the right abdomen in the lower lateral quadrant. The blow was severe enough to knock him down, but did not

prevent his continuing at work. The day following, however, he had considerable pain in the region of the kidney, and tenderness over the right side of the abdomen, with distention and rigidity. This continued rather severely until his admission to the hospital. Inspiration was especially painful. He was running a temperature from 100 to 103, with accelerated pulse. The leucocyte count showed 20,000. Examination showed the whole abdomen rigid, more marked over the appendix and right hypochondriac, where pressure was very painful. The condition was diagnosed as a possible appendicitis, but more probably as a perinephritic inflammation. There were a few râles over the lower right chest, suggesting also a pleurisy. He was kept under observation for about three weeks. During the first week the symptoms continued unchanged, and he had several chills. Then they all subsided, and he was discharged from the hospital. He continued, however, to have more or less constant pain in the region of the right kidney and was re-admitted to the hospital on March 13th. Examination at this time showed the same condition as before, but to a much less degree, and he did not have any fever. A cystoscopic examination showed no abnormalities in the ureteral orifices. The ureters were not catheterized because this procedure was, for some reason, exceedingly painful, and offered special difficulties. X-ray plates at that time showed no abnormality in the right urinary tract, but gave a shadow in the line of the left ureter. As he had had no symptoms referable to this side other than the attack three years ago, and as all his present symptoms were referable to the right kidney region, and in view of the recent injury, it was decided to explore that organ. Accordingly, operation was performed on March 20th, a right nephrotomy being done through a vertical incision. The tissues overlying the kidney were found slightly contused, particularly about the fatty capsule. The kidney was slightly more adherent than normal, and the capsule seemed somewhat thickened. A longitudinal incision was made through the kidney substance into the pelvis of the kidney just posterior to the convex border. Evidence of an old pyelitis was found in the shape of some necrotic tissue at the apices of two or three of the pyramids. It was cut away, and was reported by Dr. Ewing to be necrotic tissue. A small drain was put down into the kidney, and the wound sutured in layers. Healing by primary union took place.

There was no urinary nor purulent discharge from the sinus. About six weeks later, however, he passed two stones *per urethra,* with no antecedent symptoms in the ureteral tracts. With this exception, the subsequent history was uneventful, and he remained well until the following December. He then began to have pain over the left kidney, with tenderness and some fever. He was ill for a few days and then recovered, but still had some pain in the left kidney region. He was re-admitted to Lincoln Hospital on March 3, 1908, having been more or less invalided most of the time since the previous December. Examination indicated a low grade of sepsis, with dry skin and tongue, and considerable emaciation. Temperature, 98; pulse, 120; respiration, 28. Blood examination, 12,000 white cells; 81 per cent. polynuclears. Urinary examination showed a few red blood and pus cells; otherwise normal in quantity and composition. Aside from pain along the kidney and left ureter, there were no subjective symptoms. Neither kidney could be palpated, but considerable tenderness and rigidity was present over the site of the left side. No cystoscopic examination was made. Operation, March 11th: The patient was placed in the right lateral prone position and a vertical incision was made in the left lumbar region, exposing the fatty capsule. The kidney was very adherent by its convex surface to the lumbar wall as the result of the former nephrospexy. The adhesions were broken away with the fingers, and the kidney delivered through the wound. It was found divided into two parts, the upper quarter of the kidney being almost entirely separated by a deep depression running around the organ. The pedicle of the kidney was grasped in the fingers, and a vertical incision made through the convex border. The upper pole of the kidney was found to be a mere shell, with a necrotic lining showing a calyx connected with the ureter. Two or three spots of necrosis in the kidney substance were removed. A catheter was passed through the ureter into the bladder without meeting with any obstruction. The necrotic shell of the upper pole was cut away, and the kidney sutured and returned to its bed. A rubber tissue drain was put through the kidney substance into the pelvis of the organ. The muscles and skin were then sutured, and two cigarette drains inserted down to the kidney. A dry sterile dressing was applied, and the patient returned to the ward in good condition and a few grave negative

bacilli cultures from the kidney pelvis showed a growth of staphylococci-streptococci. There was some urinary leakage along the track of the drain for the first five days; this then subsided, and the drains were entirely removed. The sinus was practically closed by the tenth day. He continued, however, to have some pain along the site of the left ureter. On the twelfth day this pain was severe, and there was an elevation of temperature (the only fever that he had), following which the sinus opened and discharged a little purulent urine. Two days later he passed a small rough calculus *per urethram.* Convalescence was uninterrupted from this time on, and he left the hospital at the end of four weeks free from symptoms, and with the wound entirely healed.

The case is shown as illustrating the difficulty of locating small stones in the urinary tract and because of the interest attaching to the rather varied symptoms which may result therefrom.

Dr. Hartwell said that he was indebted to Dr. Osgood for taking the radiographs and making the cystoscopic examinations in these cases.

PERFORATING GASTRIC ULCER.

Dr. Charles L. Gibson presented a man, 27 years old, who had always enjoyed good health and had suffered from no digestive disturbances until the 19th of November, 1907, when he first complained of a vague discomfort in the stomach. In the middle of the afternoon he suddenly experienced an agonizing pain in the epigastrium. He also complained of severe pain in the left supraclavicular fossa, but this was temporary. The abdomen was of board-like rigidity.

The case was regarded as one of perforating gastric ulcer, and the patient was transferred to the hospital immediately and operated on within three hours after the onset of the pain. A perforation of the stomach wall was found near its pyloric end. This was closed by a double purse-string suture, and pelvic drainage maintained for 48 hours. The man made an uneventful recovery.

Dr. Gibson also presented a second patient, a truck driver, 23 years old, whose history was not unlike that of the preceding case. After moderate epigastric distress he had a violent, sudden attack of pain in the region of the stomach. He was taken to the

hospital and operated on five hours after the onset of his acute pain. He gave no previous history of gastric disturbance, and had never vomited in his life.

A fairly large perforation was found on the anterior wall of the stomach, close to the pyloric end. It was easily closed with a purse-string suture, with temporary drainage of the pelvis.

In neither of these cases, Dr. Gibson said, did he resort to a gastro-enterostomy with a permanent cure in view. He doubted whether it was desirable to complicate acute cases of this kind by such a procedure. Many of these patients after proper treatment, showed a condition of the gastric contents which was practically normal, and he did not know whether a gastro-enterostomy would eventually become necessary or not.

PERFORATING DUODENAL ULCER.

Dr. William A. Downes presented a boy, 18 years old, who about a year ago had a sudden, sharp attack of pain in the epigastrium, lasting half an hour. He did not vomit, and although he felt weak, he was able to continue with his work. Since that time he has had periods of discomfort in the epigastric region, which he attributed to indigestion. He had occasional attacks of vomiting during the past six months, but had never vomited blood nor had his stools contained evidences of blood so far as he knew.

About noon, on Saturday, March 21, 1908, while working on a scaffold with both arms extended over his head, he was seized with a violent attack of cramp-like pain in the region of the umbilicus. He did not vomit, but felt weak, and his body was covered with perspiration. After lying down for half an hour, the pain passed off, and he was able to ride home, a distance of about a mile, on a car. His supper consisted of egg, bread and butter, and the following morning he felt as well as usual with the exception of some tenderness in the right side of the abdomen. Sunday evening he consulted his physician, who made a diagnosis of appendicitis and advised operation. On Tuesday, March 24th, three days after his attack of pain, he walked to the hospital, a distance of half a mile. His temperature on admission was 99.5; pulse, 80. There was moderate rigidity of the right rectus, and indefinite tenderness in the same region. No jaundice. The bowels were open. A diagnosis of subacute appendicitis was

made, an operation advised and set for the following day. An examination of the urine made on Wednesday morning showed a trace of bile. Otherwise negative. At 1.30 that afternoon, half an hour before the time set for the operation, while lying quietly in bed, he was seized with an attack of pain similar to the one he had had on the preceding Saturday. When Dr. Downes first saw him, half an hour later, the pain had lessened somewhat, but he was lying with his knees drawn up, the body covered with cold perspiration, and complaining of intense pain in the entire right side. There was board-like rigidity of the abdomen. The diagnosis of appendicitis was then doubted. The abdomen was examined under ether with negative results.

Operation: An intermuscular incision was made over the appendix, and upon opening the peritoneum a slight amount of bile-tinged serum escaped. The appendix was readily drawn up, and its peritoneal coat was found congested. The appendix was removed and opened, but there was no evidence of disease in the mucous membrane. The abdominal wound was thereupon closed and a second incision was made over the gall-bladder. Upon opening the peritoneum at this site, there was a gush of bile-colored serum. The gall-badder, which presented in the wound, was moderately distended but apparently normal in appearance, with the exception of slight congestion of its peritoneal coat. It contained no calculi. Thinking that possibly the trouble lay in the ducts, the finger was passed along the cystic duct into the foramen of Winslow, and an indurated mass was immediately felt between the finger and the abdominal wall. This was drawn into the wound, and proved to be the duodenum. It presented an open ulcer, three-eighths of an inch in diameter, situated on its anterior surface, about an inch and three-quarters from the pylorus. There was a free escape of bile and mucus, but no particles of food. There were no fibrinous adhesions at any point. The edges of the ulcer were smooth, and there was no bleeding. There was moderate induration and œdema extending from three-quarters to one inch on all sides.

The perforation was closed by two purse-string sutures of silk. The lumen of the gut did not seem to be diminished sufficiently to warrant doing a gastro-enterorrhaphy. The bile-stained mucus was sponged away, but the abdomen was not washed out. A cigarette drain was inserted which was removed on the second

day. Food was taken by the mouth on the third day. Convalescence was uneventful.

DR. HOWARD LILIENTHAL called attention to an article by Dr. E. A. Codman which appeared in the *Boston Medical and Surgical Journal* (April 16th). In this paper the author suggested that many of these ulcerations of the duodenum and also of the stomach might be due to the chemical changes caused by compression of the duodenum by the mesentery, and he explained the beneficial results of gastro-enterostomy on the ground that it relieved the distention caused by this constriction. As a possible remedy for this condition, Dr. Lilienthal suggested transplanting a part of the constricted duodenum to the right, so that it would turn before the fold of the mesentery crossed it. Unless the anatomical causes of stagnation in the duodenum and gastric hyperacidity could be relieved, the end-results of operation for gastric ulcer were not very promising, and the speaker said he knew of one case where three such operations were necessary for recurrent ulcer.

DR. WILLY MEYER said that during the past winter he had operated on a man, 56 years old, with a gastric perforation near the pylorus. In this, as well as in a second case he had in mind, the stomach wall was so much infiltrated that a double row of Lembert sutures was necessary, the usual purse-string suture being out of the question. The case seen last winter was operated on 22 hours after perforation, and promptly recovered and left the hospital at the end of the third week. About one month later he developed ileus due to adhesions, and subsequently his symptoms pointed to a second perforation at the original site. The abdomen was again opened, and an abscess drained. The point of leakage could not be found, and the patient died. In that case, Dr. Meyer said, he felt confident that if at the time of the original operation he had done a rapid gastro-enterostomy, the future course of events might have been avoided.

In a second case which he operated on a few days ago the symptoms were apparently so mild that the patient was able to walk into the hospital. The stomach wall was so much infiltrated that Lembert sutures were necessary. In that case he did an immediate gastro-enterostomy.

DR. ELLSWORTH ELIOT, JR., said he had operated on quite

a number of cases of duodenal ulcer with very satisfactory results, and yet no gastro-enterostomy was done. On the other hand, he was inclined to agree with Dr. Meyer that in some of these cases, a secondary gastro-enterostomy might prove necessary, but as to the advisability of doing it at the time of the primary operation, that was an open question.

Dr. Eliot said that a review of his old cases of gastric and duodenal ulcer showed that in a great majority of the cases the perforation occurred without premonitory symptoms.

Dr. Charles H. Peck said he agreed essentially with Dr. Eliot's views. He had had eight cases of perforating gastric and duodenal ulcer, and in none of them had he done a gastro-enterostomy at the time of the primary operation. Six of his cases recovered, and of the five of these that he had been able to follow none had shown any symptoms that demanded a secondary gastro-enterostomy. In several of these cases, the perforation was near the pylorus, and in more than one he feared that sufficient narrowing of the pylorus would occur to require a gastro-enterostomy. Personally, Dr. Peck said, he believed that the gastro-enterostomy should not be done as a routine measure at the time of the primary operation, but only as a secondary operation if the symptoms warranted it.

Dr. Joseph A. Blake said the question of whether a gastro-enterostomy should or should not be done depended entirely on the degree of obstruction to the pylorus. Of course, in deciding whether a gastro-enterostomy should be done at once or subsequently, one had to be guided largely by the condition of the patient at the time. Many of these patients are in very good condition. In a case which he operated on recently there was complete stenosis of the pylorus after closure of the ulcer, and a gastro-enterostomy was immediately done. Gastro-enterostomy should not be a routine procedure in these cases, the indications for it being the same as in ulcer of the stomach without perforation. Dr. Blake said he did not think it was necessary to resort to drainage in these cases; they got along perfectly well without it.

CARCINOMA OF THE MALE BREAST.

Charles L. Gibson presented a man, 62 years old, whose past history was unimportant. Until about four months before coming under observation, when he first noticed a lump in the

right breast, which grew slowly. When Dr. Gibson first saw the patient, the growth had attained the size of an adult palm, and was adherent to the chest wall. A pathological examination showed it to be a typical carcinoma, having apparently begun in the gland tissue. There were no enlarged glands in the axilla. The mass was excised and the defect remaining was closed with skin grafts.

Dr. Gibson said frequency of carcinoma of the breast in men, is estimated within widely varying limits, some observers placing it as high as one in men to twenty in women, others as one in a hundred.

Dr. H. Lilienthal said that in two cases of carcinoma of the male breast coming under his observation, one was attributed by the patient to the more or less constant irritation of the nipple caused by his suspender buckle.

Dr. William B. Coley said he had seen two cases of carcinoma of the male breast. One began as a case of Paget's disease of the nipple, while in the other the tumor was within the breast.

Dr. John F. Erdmann said he had seen four cases of carcinoma of the male breast, one recently, and three that were already on record. Two began about the nipple: in the other two he could not say where they originated.

INOPERABLE ROUND-CELLED SARCOMA OF THE BACK, WITH METASTATIC TUMORS INVOLVING A LARGE PORTION OF THE LOWER JAW—ENTIRE DISAPPEARANCE UNDER TWO AND A HALF MONTHS' TREATMENT WITH THE MIXED TOXINS.

Dr. William B. Coley presented a man, 27 years of age, who had always been in good health previously; good family history; no history of injury, first noticed a tumor in the lower lumbar region in September, 1907. This grew with great rapidity and had reached the size of two fists in the latter part of September, when it was operated upon at the City Hospital by Dr. J. C. Biddle. A portion of the tumor was sent to the Jefferson Medical College Hospital, and the examination was made by Dr. John Funke, the pathologist to the hospital, who pronounced it large round-celled sarcoma. The tumor was apparently of fascial or muscular origin; it did not involve the bone, but extended down to and around the spinal nerves. It recurred immediately and

reached its original size, when a second operation was performed in the latter part of October by Dr. Biddle. At about this time a metastatic tumor developed in the lower jaw. The patient was sent by Dr. C. B. Dreher, of Tamaqua, Pa., for advice on November 16, 1907. Examination at this time showed a large, unhealed wound in the lumbar and sacral region, 6x8 in. in extent, the unhealed portion being the shape of an excavation nearly an inch deeper than the surrounding surface. The bottom of the wound showed evidence of recurrence. The lower jaw showed a metastatic tumor beginning one inch to the left of the symphysis on the right side and extending to the angle of the jaw on the left, occupying the entire thickness of the jaw. The patient had lost more than 40 pounds in weight; he was cachectic in appearance, and unable to walk without help. Although the chances of success from the toxins were exceedingly slight, they were sufficient to make it wise to give the method a trial. One quarter minim injected into the gluteal region was the initial dose; the latter was gradually increased until a temperature reaction of 102–103° was produced. Under these systemic injections, the tumor of the jaw began to diminish in size and became very much softer. When it had become almost fluctuating, an incision was made over the most protuberant part, and it was found so highly vascular that it was difficult to control the bleeding. The patient's general condition began to improve after the first 2–3 weeks' treatment. The tumor in the jaw became gradually less and less vascular, and after six weeks' treatment a portion of it was curetted out through the exploratory incision, and examined microscopically. It was found to be a round-celled sarcoma, of the same type as the primary disease. By this time the improvement in his general condition became much more rapid, and he gained 16 pounds in a single month. The wound healed rapidly, and all evidence of tumor growth, both in the back and jaw, had disappeared at the end of 2½ months' treatment, with 47 injections. The patient left the hospital on February 8, 1908, and the treatment was continued once a week by his family physician, after his return home, only small doses being given, not sufficient to produce any marked reaction. The largest dose in this case was 8 minims. All the injections, with the exception of five of the filtered toxins made into the jaw, were systemic, being given in the gluteal region and thigh. At the present time, about six

months after the beginning of the treatment, or three months after the tumors disappeared, the patient is in perfect health. He has resumed his work, and has gained 49 pounds in weight. There is not the slightest evidence of a tumor remaining, either in the jaw or in the back.

SUPPURATIVE ARTHRITIS OF THE KNEE.

DR. GEORGE PECK, in the absence of Dr. George E. Brewer, presented a negro boy, who was admitted to the service of Dr. Brewer at Roosevelt Hospital for a penetrating gun-shot wound of the left knee-joint. The case was first treated by exploration and drainage, but it was subsequently found that the bullet had injured the internal condyle of the femur, and septic symptoms developed. Five days after the injury Dr. Brewer exposed the knee-joint, and put the leg up in a flexed position; in this posture it was drained for six weeks; then a typical resection was performed, and the leg replaced in complete extension, the method followed being that of Mayo. The operation was done on the 10th of last March. The patient made a good recovery; he still wore a splint.

UNDESCENDED TESTIS ASSOCIATED WITH INGUINAL HERNIA.

DR. JOHN B. WALKER presented a boy of 19 years, who came under treatment for an undescended right testis associated with an inguinal hernia on the same side. Upon operation the testis was found lying above the internal ring in peritoneal cavity. It was brought down into the scrotum, where it has since remained. It is unusual to find the testis in the abdominal cavity and requires more than usual dexterity to free it so that it remains in the scrotum.

REPOSITION OF ABDOMINAL UNDESCENDED TESTIS IN SCROTUM, FOLLOWED BY NECROSIS.

DR. CLARENCE A. MCWILLIAMS presented a man, 22 years old, who since his third year had had a left inguinal hernia, and absence of the testis on that side. He applied for operation for his hernia, and upon opening the inguinal canal the missing testis was found just inside the internal ring. It was about half the size of a normal testis. The vas descended beside the testis to

the external ring, and then curved upwards again to the testis. On attempting to bring the testis down it was necessary to divide the pampiniform plexus, and in doing this the artery of the vas was accidentally cut. Following this there was no difficulty in getting the testis into the scrotum, and then the hernial operation was completed.

About a week after the operation there was fluctuation in the scrotum, and an incision showed that the testis had necrosed in its new position. The hernial wound remained perfectly clean. The necrosis of the testis, Dr. McWilliams said, would probably not have occurred if the artery of the vas had not been divided.

THE TREATMENT OF UNDESCENDED OR MALDESCENDED TESTIS, ASSOCIATED WITH INGUINAL HERNIA.

Dr. William B. Coley read a paper with the above title for which see page 321.

Dr. Coley also showed a number of patients illustrating his subject. The histories of these cases were contained in his paper.

Dr. Charles N. Dowd, referring to the technic of the operation, said that nine years ago, at a meeting of this Society (Annals of Sugery, '99, vol. xxx, p. 338), he showed two cases where he had sutured the cord at the external ring, passing small chromic gut sutures through the fibrous tissue of the cord and through the external oblique aponeurosis. Since then he had followed the same procedure in many cases and he was convinced that it was of distinct advantage. It is difficult to speak positively in regard to the advantages of any particular technic, because the cases themselves differ so widely. The speaker said that in a recent case of double undescended testes with conditions the same on both sides he had on one side stitched the cord to the margin of the external ring and also stitched the tunica albuginea to the scrotum, while on the other side he omitted to do this. The result was much better on the side in which the stitches had been taken.

Dr. John B. Walker said that in most of the cases he had seen, the difficulty in bringing down the testis was due to the shortness of the sac. On opening the sac in the inguinal canal, he was able to bring the cord down to the external ring, where it turned back on itself. On attempting to bring down the testis, very little progress was made, but on dividing the sac, the testis

was immediately released. The speaker said he never had a case in which he was unable to bring the testis down by this method, and he had never seen atrophy result.

Dr. Blake said that if the operator took advantage of the Fowler method of dividing the deep transversalis fascia from the external ring to the spine of the pubes, an inch or more could be gained in the transplantation of the cord. It afforded a more direct route in bringing the cord down to the scrotum. Another point in the technic was to make use of the external oblique and the intercolumnar fascia to crowd down the testis.

Dr. Erdmann, commenting on the statement contained in Dr. Coley's paper that strangulated inguinal hernia of the superficial variety associated with undescended testis was rare, said he had operated upon four or five such cases.

Dr. Coley, replying to Dr. Erdmann, said he had seen but a single case of strangulated omental hernia associated with undescended testis, and they had never seen a case of strangulated hernia at the Hospital for Ruptured and Crippled, associated with undescended testis.

The point of suturing the cord at the external ring, which Dr. Dowd had suggested a number of years ago, had more recently been claimed by a French writer, who had resorted to it in 15 cases with very satisfactory results. Dr. Coley said that personally he had never tried it, but he thought the idea was a very good one. The same was true of the point in technic suggested by Dr. Blake to assist in bringing down the cord.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, Held Monday, April 6, 1908.

INFANTILE PARALYSIS TREATED BY TENDON TRANSPLANTATION AND NERVE ANASTOMOSIS.

Dr. Astley P. C. Ashhurst presented several patients from the Orthopædic Hospital, from the services of Dr. G. G. Davis and Dr. R. H. Harte, to whom he was indebted for permission to operate and to report the operations.

Case I.—*Paralytic Varus; Transplantation of Tibialis Anticus into the base of the fifth metatarsal bone.*

Alfred C. came to Dr. Harte's clinic, April 20, 1905, when 11 years of age. In December, 1901, when 7 years old, he had had a disease in which both legs and arms were paralyzed, and which confined him to bed for five months. The boy was unable to walk alone for a year afterwards. His family physician has informed Dr. Ashhurst that the diagnosis of cerebrospinal meningitis was confirmed by the board of health. When seen at the Orthopædic Hospital the chief complaint was that the left ankle turned very easily, and that the boy was constantly falling; there was quite a noticeable limp. The peroneal muscles were paralyzed, and there was a mild degree of varus, the foot turning easily until the sole was parallel with inner surface of the tibia. He had been wearing a brace for several years. A new brace was ordered which held the foot in perfect position. The patient wore this brace for nearly two years longer; and it was then decided, as no further improvement had occurred, to resort to operation. As a preliminary the foot was stretched manually, and put up in plaster in an over corrected (valgus) position, on February 18, 1907. On April 4, 1907, Dr. Ashhurst transplanted the tendon of the tibialis anticus to the base of the fifth metatarsal bone. The cast was changed at the end of three weeks,

and a new one applied for five weeks longer. At this time, eight weeks after the operation, the transplanted tendon was firmly attached at its new insertion, and by its contraction flexed the foot into a very slight valgus position. A shoe was ordered, with its sole raised on the outer side, so as to maintain over-correction for some time longer. Two months later it was noted that all the motions of the foot were normal, the transplanted tibialis anticus everting and flexing the foot well, while the power of inversion was retained by the tibialis posticus. The boy now walks without any limp, never falls from turning of the ankle, and except for the scars of operation, it is difficult to tell which was the paralyzed foot.

CASE 2.—*Paralytic Valgus, ankle-drop, and knee-drop. Transplantation of peroneus brevis to the base of the first metatarsal bone; and transplantation of the gracilis and semi-tendinosus to the upper border of the patella.*

Frank W., entered the service of Dr. G. G. Davis, February 26, 1907, when 11½ years of age. He had had infantile palsy at the age of 10 months, and had been under the care of Dr. T. G. Morton, who ordered a brace and had the patient treated with electricity. Later at the University Hospital, an operation (arthrodesis?) was done on the ankle, and a brace was ordered. When the patient came to the Orthopædic Hospital he could hardly walk at all without his brace, having to put his hand on his left knee at every step to keep it from collapsing like the blade of a pocket knife into the handle, as there was absolutely no power of holding the knee extended. Besides the paralysis of the quadriceps extensor femoris, the following muscles of the foot were paralyzed: tibialis anticus, extensor longus hallucis, extensor longus digitorum, tibialis posticus, and flexor longus hallucis; the calf muscles were weak, but contracted feebly. The only muscles which contracted well were the peronei, and the flexor longus digitorum. On April 17, 1907, Dr. Ashhurst transplanted the peroneus brevis to the base of the first metatarsal bone, to replace as far as possible the paralyzed tibialis anticus; at the same time the gracilis and the semitendinosus were transplanted into the upper margin of the patella. The plaster cast was removed eight weeks later, and, after the patient's old brace had been fitted, another cast was applied while alterations were being made in the brace. It was found possible to dispense with

the apparatus above the knee, as the transplanted hamstring muscles effectually prevented the collapse of the knee in walking, although voluntary extension is not yet possible. He never falls down now, and the transplanted peroneus muscle can slightly invert the foot and correct the extreme valgus deformity present before the operation. The boy, however, still wears the old brace to keep his foot in good position, and it seems probable that arthrodesis will have to be resorted to before the brace can be entirely discarded. There is also paralysis of the erector spinæ group of muscles, and the limp, due partly to the shortening of the whole lower extremity, is aggravated by the extreme lordosis.*

CASE 3.—*Paralytic calcaneus, with varus and foot-drop. Transplantation of the anterior tibial nerve into the musculocutaneous; and of the peroneus longus muscle into the insertion of the tendo Achillis.*

Fred J. S.. entered Dr. Davis's service February 26, 1907, when 7 years of age. He had had infantile palsy at the age of 2 years, affecting both legs. The left leg largely recovered its functions, only a slight cavus deformity remaining. The right foot showed moderate calcaneus, with varus and foot-drop. The peroneal muscles contracted well, but there was paralysis of the following muscles: tibialis anticus, extensor longus hallucis, extensor longus digitorum, flexor longus digitorum, flexor longus hallucis, and the muscles of the calf. The condition of the tibialis posticus was doubtful, but it was certainly very weak. The only voluntary motion possible was a very feeble extension (plantar flexion) and abduction of the foot by contraction of the peroneal group. There was no power of raising the heel, and if there had not also been foot-drop, the boy would doubtless have walked on his heel with his toes in the air, as in pure paralytic calcaneus. As the entire distribution of the anterior tibial nerve, embracing the tibialis anticus, the extensor longus hallucis, and the extensor longus digitorum, was paralyzed, while the entire distribution of the musculocutaneous nerve was intact, the case seemed a suitable one in which to attempt to divert some of the nerve impulses from the latter into the anterior tibial nerve. It was determined at the same time to transplant

* On June 3, 1908, Dr. Ashhurst did arthrodesis of the ankle-joint and of the subastragalar joint in this patient.

the peroneus longus into the calcaneum, so as to overcome as much as possible the calcaneus, which was the most disabling deformity. On June 1, 1907, Dr. Ashhurst isolated the musculocutaneous nerve by dissecting through the peroneus longus muscle, just below the head of the fibula. After finding the musculocutaneous nerve on the surface of the fibula, the anterior tibial nerve was easily located just to its mesial side, before it had perforated the septum between the peroneus longus and the extensor longus digitorum. Two sutures of very fine silk, threaded in ophthalmic needles, were then passed through the sheath of the anterior tibial nerve, one on either side, and after this had been done, the nerve was divided with a tenotome above this point, just below its recurrent articular branch. Then a longitudinal slit was made with a tenotome in the musculocutaneous nerve, and by means of the sutures previously placed in the musculocutaneous nerve the latter was drawn into the slit in the anterior tibial nerve, and sutured to the sheath of the anterior tibial nerve. Two other sutures were placed above and below the first two, through the sheaths only, to act as guys, and relieve any possible tension on those first placed. The deep fascia was closed with interrupted silk sutures, and the skin with chromic gut sutures. Then the peroneus longus tendon was divided at the base of the fifth metatarsal bone, and transplanted into the periosteum at the insertion of the tendo Achillis. The time of the operation was 40 minutes. A plaster cast was applied, extending to the middle of the thigh. After six weeks a new cast, extending only to below the knee, was applied, and worn for several weeks longer. At no time was there any evidence of injury to the musculocutaneous nerve, into which the paralyzed nerve had been transplanted. Since August, 1907, the patient has been wearing his old brace. There has been absolutely no result from the nerve anastomosis, the muscles supplied by the anterior tibial nerve having no more power than before the operation. The transplanted peroneus longus muscle has restored a slight degree of power of raising the heel, and has at all events prevented a recurrence of the calcaneus deformity. Subastragalar arthrodesis will probably be required later, as the foot is still rather flail-like.

CASE 4.—*Paralytic valgus; transplantation of peroneus longus and brevis into base of first metatarsal bone.*

This case was reported at the last meeting of the Academy by Dr. G. G. Davis, in connection with his operation of transplantation of the tensor fasciæ femoris for outward rotation of the lower extremity from infantile palsy. The operations were done October 22, 1907. The transplanted peroneal muscles act well, and overcome almost entirely the previous valgus. An ordinary shoe is worn, and the slight limp is due chiefly to the shortness of the paralyzed leg.

CASE 5.—*Paralytic valgus; transplantation of peroneus brevis and extensor longus hallucis into base of first metatarsal bone.*

Pasquelino R., aged 7 years, had infantile palsy when four years old, and had never received any treatment for the resulting deformity. He entered Dr. Harte's service at the Orthopædic Hospital October, 1907, with marked valgus of the right foot. The tibialis anticus was paralyzed, but the extensor longus hallucis and extensor longus digitorum contracted well, and the peroneal muscles also appeared to be normal. The boy walked on the inner surface of his foot, with a very marked limp. On December 10, 1907, Dr. Ashhurst transplanted the peroneus brevis into the base of the first metatarsal bone, and as it did not appear to be as strong when seen at operation as it had been thought to be before, the tendon of the extensor longus hallucis was divided on the dorsum of the foot, and after suturing its distal end to the neighboring tendon of the extensor longus digitorum, its proximal end was also sutured into the base of the first metatarsal bone, at the point of insertion of the tibialis anticus, thus supplementing the paralyzed tibialis anticus by both the peroneus brevis and the extensor longus hallucis. The plaster cast was removed two months later. The transplanted muscles now contract satisfactorily, and while there is no over-correction, the valgus deformity has been overcome, and the arch of the foot restored. The patient wears a shoe with its sole raised on the inner side, and is able to walk very well without any kind of apparatus, and with a scarcely noticeable limp.

CASE 6.—*Paralytic valgus; transplantation of peroneus longus into base of first metatarsal bone, and transplantation of distal end of tibialis anticus into extensor communis digitorum.*

William M., entered Dr. Harte's service at the Orthopædic Hospital, May 4, 1905, at the age of 7 years. He had had

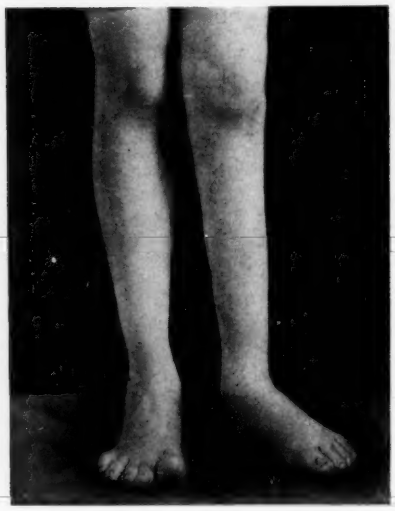
FIG. 1.

Case I. Position of transplanted tibialis anticus outlined on the skin.

FIG. 2.

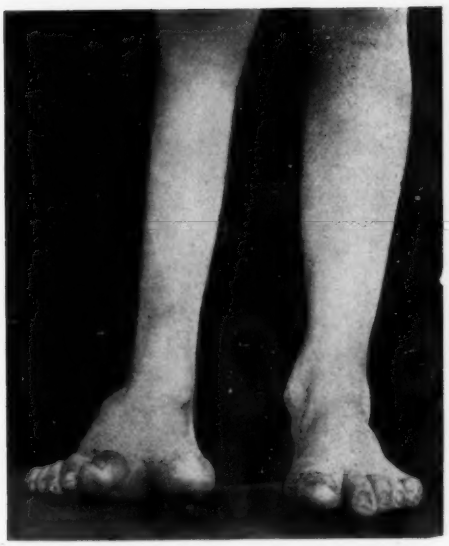
Case II. Paralytic valgus before operation.

FIG. 3.



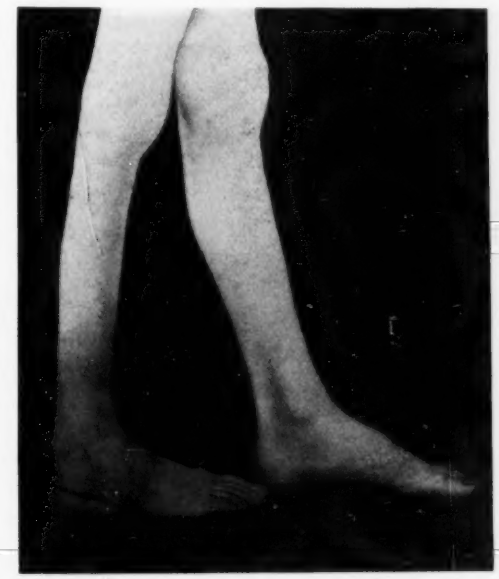
Case II. Paralytic valgus after operation

FIG. 4.



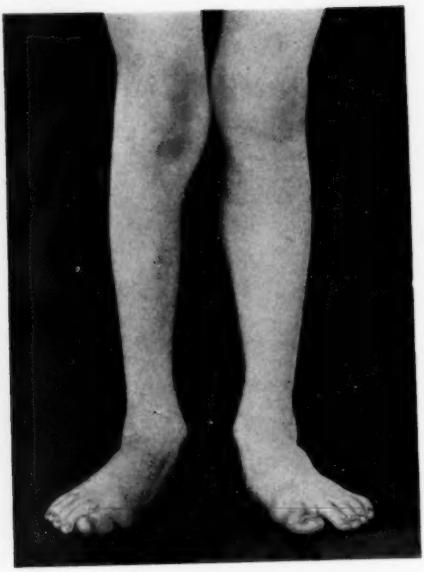
Case III. Paralytic calcaneus with varus and foot-drop. Before operation.

FIG. 5.



Case III. After operation. The incisions for the nerve-anastomosis and for the tendon transplantation have been outlined on the skin.

FIG. 6



Case V. Paralytic valgus. Before operation.

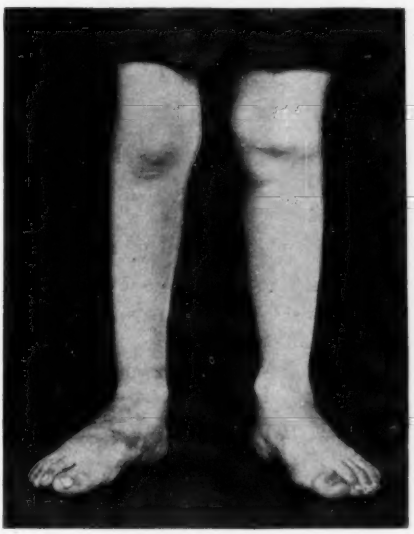
FIG 7.

Case V. After operation.

FIG. 8

Case VI. Paralytic valgus. Before operation.

FIG. 9.



Case VI. Paralytic valgus. After operation

infantile palsy at the age of 2 years, which had left him with valgus and slight ankle-drop of the right foot. The tibialis anticus, tibialis posticus, and extensor longus hallucis were paralyzed; the extensor longus digitorum contracted well, and the peroneal muscles appeared to be normal. A brace was ordered, but the patient did not return to the Orthopædic Hospital for nearly two years, when it was found that an operation of some kind (apparently shortening of the tibialis anticus) had been done by a homœopathic doctor. The boy was now wearing a brace, and his foot was if possible in a more deformed condition than at his first visit. Without the brace there was marked toe-drop, and he walked on the inner side of his foot, his sole turning outwards. He was admitted to the ward of the Orthopædic Hospital in October, 1907, and his foot was forcibly stretched under an anæsthetic on October 24, November 7, and November 30. The deformity having now been entirely overcome, Dr. Ashhurst operated December 31, 1907. The peroneus longus was transplanted into the base of the first metatarsal bone, and as it did not appear to be very strong, and as the extensor longus hallucis was entirely paralyzed, the tendon of the tibialis anticus was divided above the annular ligament, and its distal end was sutured under tension to the tendon of the extensor longus digitorum, which was normal, thus pulling the foot into the varus position. The plaster cast was removed two months later, and the result was found to be more satisfactory than had been anticipated: by flexion of the ankle through the extensor longus digitorum the distal end of the tibialis anticus is also pulled upon, so that the foot is no longer everted, but can be somewhat inverted also. The patient wears a shoe with its sole raised on the inner side, to maintain the over-corrected position.

Dr. John H. Jopson discussed the result in the second case shown by Dr. Ashhurst, in which he transplanted the gracilis and semitendinosus into the upper border of the patella. The patient is greatly improved, there being additional strength given to the knee. But the lack of power of voluntary extension would seem to support the views of Lange, who advises that in transplanting the ham-string tendons the entire group be transplanted rather than a couple of muscles, as in this way there is a much

greater chance of achieving early alteration of function of the muscle from a flexor to an extensor.

Dr. G. G. Davis referred to the question raised by Dr. Jopson as to the utility of transplanting certain parts of a group of muscles. Dr. Davis said that in practically all of the cases, even where there was a transplantation of but a single muscle, the result was satisfactory; that he has had cases in which the transplantation of the semitendinosus has been sufficient, and although it might not give the power of extension which would be derived from the transplantation of the entire group of flexor muscles, it was nevertheless sufficient to steady the knee, rendering it possible to dispense with the use of any apparatus. The main object of the operation is to give sufficient power of extension to prevent the knee from suddenly flexing as the patient walks and he believes that this result can be obtained in some cases by the transplantation of a single muscle.

Dr. John H. Jopson said that he had not meant to criticise the operation which had been done in the case discussed, as the result was an excellent one, but thought the case referred to was a good example of the contention raised by Lange. When tendon transplantation was first brought forward it was claimed that one could alter at will the function of the muscle as easily as we could change its insertion. This claim has been found somewhat exaggerated, and as a result there had been for a time a revulsion of feeling in regard to the operation.

Dr. William L. Rodman said that three weeks ago he had anastomosed the musculospiral for wrist-drop, doing practically the same operation as Dr. Ashhurst, bringing the distal end of the nerve over to the median, by transfixing the brachialis anticus muscle and anastomosing it with the median and musculocutaneous. At the present time there seems already return of sensation in the skin over the hand and fingers.

Dr. Ashhurst, in closing, said, in reply to inquiry, that he did not know how long one should expect to wait for a nerve to regenerate; ten months had elapsed in the present case. He said that he had seen statements that even one or two years should be allowed to elapse before hope of a good result should be abandoned; and said that if in that length of time his patient should be fortunate enough to obtain return of power, he would take pleasure in showing the boy again.

TWENTY-FIVE HUNDRED CASES OF GAS-ETHER ANÆSTHESIA WITHOUT COMPLICATION.

DR. J. J. A. VAN KAATHOVEN (by invitation) read a paper with the above title, for which see page 435.

DR. JOHN B. ROBERTS thought the reader had brought out a point not always insisted upon, namely, that very little ether is needed after the patient once becomes etherized. Dr. Roberts said that it would seem from his experience with the Resident Physicians who administer ether for him that they had never been taught the importance of this fact. They get the patient etherized for the surgeon and then continue to pour on as much ether as they did at the start. He thinks Dr. Van Kaathoven has properly emphasized the need of plenty of ether to start with but very little afterwards, and the desirability of having the patient in such condition that he comes out of ether as soon as the operation is over. He is inclined to believe that what is called the "drop method" has been so talked of recently that many men are claiming to give ether by what they call the "drop method" when they are really pouring more ether on the inhaling apparatus than is done by those who know what is scientific administration of the anæsthetic. After all, it is not the "method" that is to give safety to the patient, but the experience and brains and attention of the administrator.

DR. G. G. ROSS said that there were two things about serious operations which gave him an undue amount of alarm. The first is the junior resident who gives the ether and the other is the unsophisticated female who handles the gauze. He thinks that the danger does not lie so much in the ether as in the man who is giving it. In hospitals where they do not have teaching in connection with the other hospital work and therefore no teacher for that particular art, he thinks it would be wise to have an official anæsthetizer on the senior staff who would be responsible for the instruction of students or residents until they are fully qualified to give ether properly and safely.

DR. G. G. DAVIS said that the use of nitrous oxide preceding ether anæsthesia is an old one although it seems to be coming into favor only now in this progressive country; it was commonly used in London over twenty-five years ago, and he thinks a method which has taken so long to establish itself on an acceptable basis argues either that the public is very slow in recognizing

the utility of good things or else it is not worthy of recognition. The objections to the method are in the first place, that it requires more experienced anæsthetizers and it gives rise to very considerably more mucus, and the transition from nitrous oxide to ether is liable to be unsatisfactory, especially, Dr. Davis believes, when the so-called "drop method" is used. We hear of eight to sixteen layers of gauze but personally Dr. Davis has never liked gauze, thinking it inferior to a close meshed towel in efficiency. Time and time again he has had the anæsthetizer fail to anæsthetize the patient rapidly, simply on account of the amount of air which is inhaled. He believes in deliberately excluding air when it is desired to rapidly anæsthetize the patient.

As regards the advantages of nitrous oxide, Dr. Davis was not prepared to admit with Dr. Van Kaathoven, that it leaves the patient in better shape than a simple anæsthesia with ether. If ether is used alone and time is taken in its administration, he believes it is the safest anæsthetic agent, and if it is preceded by the morphia and atropine injections its results would be as good, as far as the after-effects go, as if preceded by nitrous oxide.

Dr. William L. Rodman said that he thought it had long ago been conceded that ether is best preceded by nitrous oxide. He also believes that chloroform can be preceded by nitrous oxide in the majority of instances. He was particularly glad to hear that one hundred students at the University had been allowed to administer the anæsthetic. He does not think it a broad position to say that a paid anæsthetist should be in every hospital; certainly not in teaching hospitals, for if the students are to be sent out without practical experience, how can they be expected to give an anæsthetic. Dr. Rodman thinks that it is perfectly safe for students to give ether under competent instructors inasmuch as the danger signals are thrown out promptly and are easily recognized and met. During the past term every senior student at both the Woman's Medical College and the Medico-Chirurgical College has given an anæsthetic. He thinks that the giving of anæsthetics is one of the most important things to be taught students. Dr. Rodman agrees with Dr. Van Kaathoven that the drop method is the best. Also that if ether is not to be preceded by gas a most valuable adjuvant is talking to the patient, for he has literally seen patients almost talked to sleep. He is impressed with the fact that ether is not as safe

an anæsthetic as is generally thought; there is a great deal of pneumonia following it. He does not consider it safer than chloroform. He has given chloroform as often if not more frequently than ether and has never seen a death from it in his own practice, but he has had three deaths from ether. When a patient goes off the table after chloroform one can be easy about him, whereas it is the reverse with ether; they are apt to have suppression of urine, develop pneumonia or bronchitis. For these reasons Dr. Rodman prefers giving chloroform in nephritis rather than ether. He thinks that in hospitals where it is practicable, ether should always be preceded by nitrous oxide, as he believes this will reduce the mortality rate from the administration of ether very materially.

Dr. Charles H. Frazier does not believe surgeons connected with non-teaching hospitals realize how much they are handicapped in educational institutions where a greater part of the routine surgical work is carried on with students as etherizers and assistants. It is not fair to criticise a junior resident at the hospital because he is not at the time he enters upon his work a skilled anæsthetist. The fault lies with the organization of the clinic and the administrative officers of the hospital. To assign to a junior resident the responsible post of anæsthetizer is a practice worthy only of condemnation and fortunately long since abandoned by many hospitals.

Dr. Oscar H. Allis said that the discussion on this subject had helped him to understand why it was so hard to teach the young men who came to the Presbyterian Hospital the way in which to administer an anæsthetic, as they had administered it two or three times somewhere else and thought they knew it all. It seemed to make no difference to them that Dr. Allis had had thirty-five or forty years of experience. Dr. Allis said that operators often become impatient and hurry the anæsthetizer; for his part he never hurried the anæsthetizer, and always considered his duty as important as was his own as operator. He has sometimes seen the patient almost dead from an overdose of ether, and the anæsthetizer still pouring it on, wholly oblivious to the patient's critical condition. He thinks that anæsthetizers are as a general rule too much interested in the work of the surgeon and not enough interested in their own important duties.

Dr. Allis said that any one who knew anything about ether felt that he knew nothing, as the dangers and responsibilities change with each individual case. He thinks it would be a wise arrangement if each hospital had a well paid expert anæsthetizer.

Dr. John H. Gibbon emphasized one improvement which has been made in general anæsthesia, namely, reduction in the amount of ether which is given. Where gas or ethyl chloride is given first, and especially where these agents have been preceded by morphia and atropine, the patient can be fully anæsthetized in from three to four minutes. The morphia and atropine given twenty minutes or half an hour before the anæsthetic is started reduces the amount of ether necessary during the progress of the operation. By following out this plan the ether given the patient is reduced to the minimum, and the after-complications which result from ether are greatly reduced. Dr. Gibbon wished to know in what number of the 100 cases which Dr. Van Kaathoven stated had been anæsthetized by students, and in 81 per cent. of which no subsequent nausea or vomiting had occurred, morphia and atropine had been given prior to the anæsthetic.

Dr. Van Kaathoven, in replying to Dr. Gibbon's question as to the number of patients who had morphia and atropine given beforehand in the series of 100 anæsthetized by students, said that he did not think over 20 per cent. received this preliminary treatment, and that in at least fifty private cases there was the same percentage. He does not think the morphia renders the patient more prone to nausea. After the patient becomes conscious from the anæsthetic he often passes off into a comfortable sleep.

With reference to Dr. Allis' remarks, Dr. Van Kaathoven said that he realized the difficulty of impressing the student with the fact that just because he has a bottle in his hand there is no reason why he should always be pouring from it, and that it is only by keeping them to the other extreme that he is able to impress upon them the importance of not anæsthetizing too deeply. One never knows what is going to happen and it is therefore of the utmost importance to pay strict attention to the patient at all times.